

DEPARTMENT OF DEFENSE APPROPRIATIONS FOR FISCAL YEAR 2015

WEDNESDAY, MAY 21, 2014

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 10:03 a.m., in room SD-192, Dirksen Senate Office Building, Hon. Richard J. Durbin (chairman) presiding.

Present: Senators Durbin, Cochran, Shelby, and Murkowski.

ENERGY SECURITY AND RESEARCH

STATEMENT OF HON. DENNIS MCGINN, ASSISTANT SECRETARY OF THE NAVY, ENERGY, INSTALLATIONS AND ENVIRONMENT

OPENING STATEMENT OF SENATOR RICHARD J. DURBIN

Senator DURBIN. Good morning. Today, the Subcommittee on Defense Appropriations meets to receive testimony regarding the operational energy programs of the Department of Defense (DOD), and how the Department is incorporating climate change into strategic planning.

I would like to welcome our witnesses, Dennis McGinn, Assistant Secretary of the Navy for Energy, Installations, and Environment; Edward Morehouse, Jr., Acting Assistant Secretary of Defense for Operational Energy Plans and Programs; Dr. Daniel Chiu, the Deputy Assistant Secretary of Defense for Strategy; and Brigadier General Kenneth Lewis, Deputy Director of Trans-Regional Policy and Partnership Strategy on the Joint Staff. Thank you.

Energy is not often the first thing that comes to mind when we picture our military, but it is an increasingly important consideration. The Department of Defense is the largest energy consumer in America, spending roughly \$20 billion a year to move people and equipment, sustain missions, keep installations running.

Liquid fuel use is the main driver of these costs, totaling an estimated 111 million barrels of oil, including 9 million barrels in Afghanistan alone.

In addition to financial cost, energy limitations also constrain our military's ability to project power. A Marine Corps forward operating base lasts only as long as its energy supply.

Lieutenant General James Mattis, during Operation Iraqi Freedom, put it another way: Unleash us from the tether of fuel.

ENERGY SAVING COSTS

The Office of Operational Energy Plans and Programs was created in 2010 to coordinate operational energy programs, particularly efforts to reduce demand, expand supplies, and lead innovative research, so that our warfighters can have lighter, more fuel-efficient equipment. These projects take many forms and are seen all around the country, and underscore the Department of Defense's willingness to make saving energy a standard operating procedure. U.S. Transportation Command, based at Scott Air Force Base in my home State of Illinois, is constantly working on the most effective, efficient ways to move troops and material. Researchers are hard at work reducing the weight and improving the performance of portable batteries that our soldiers carry. The Navy is participating in the advanced drop-in biofuels program with the goal of empowering a great green fleet in 2016. Ethanol and biodiesel fuel plants in Illinois account for over 10,000 jobs and hundreds of millions of dollars in payroll.

The services are executing an increasing amount of energy saving performance contracts for infrastructure improvements. A recent contract at Rock Island Arsenal in my State promises to reduce energy use by 35 percent and result in a \$5.3 million annual savings in energy and operational costs.

Every advance we make in this area is a win. It means safer supply lines, less weight to hike over mountain passes, and increased ability to operate independently in a hostile environment. In an era of tight budgets, better stewardship of energy means there is more money for other critical defense priorities.

The Department has also realized that climate change is a national security threat. And it is appropriate for the subcommittee to hear more about this risk and how it is being incorporated into our strategy.

Climate change has been in the news the last few weeks. Two weeks ago, the U.S. Global Change program released its third national climate assessment, again confirming that climate change is an immediate threat to the United States and the world. Last week, it reported the collapse of the West Antarctic ice sheet is underway and likely irreversible.

Last week, a group of 16 Generals and Admirals, with hundreds of years of military experience between them, issued a report entitled, "National Security and the Threat of Climate Change." It identified a number of critical considerations.

What will the sea level rise mean for our military installations operating in all 50 States, 7 U.S. territories, 40 foreign countries? The report's image of what is left of Norfolk Naval Base after a sea level rise of a few feet is dramatic. How must our military adapt to continue to train and operate effectively?

The report notes that 2 years ago at Fort Hood, drought had become so persistent on training grounds that to prevent wildfire, the military had to drench its artillery range with water from helicopters before practicing with high explosives. The Marine Corps base at Miramar has had similar restrictions for years.

How are we planning for more extreme weather events? The report argues our National Guard will be even busier at home and

that our combatant commanders will continue to see an uptick abroad, especially in the Asia-Pacific. These concerns mirror those of our senior military officers and leaders.

In 2008, the National Intelligence Council judged that more than 30 U.S. military installations were already facing elevated levels of risk from rising sea levels.

Similarly, in 2010 and again in 2014, the Quadrennial Defense Review identified the effects of climate change as a risk that must be incorporated into defense planning. We look forward to hearing more about what that means for our troops.

In conclusion, our military is unparalleled in its ability to execute a mission wherever, whenever necessary for our national security, and to overcome any challenge along the way. These issues relating to energy and climate are no different, and I look forward to the views that will be expressed from this panel.

Let me turn it over to my ranking member, Senator Cochran.

ENERGY RESEARCH

STATEMENT OF SENATOR THAD COCHRAN

Senator COCHRAN. Mr. Chairman, I am pleased to join you in welcoming these distinguished witnesses to the Defense Subcommittee to discuss energy security and research.

We look forward to hearing their perspectives on proposals for Federal funding of energy and related technology initiatives in the fiscal year 2015 budget request.

This subcommittee has been supportive of alternative energy research, reflecting the fact that while members may disagree about issues such as the causes of climate change, we can all agree that developing alternate sources of energy is vital to military operations and national security.

Thank you for joining us today as we continue to consider specific recommendations for resource allocations to support our military and protect our national security interests.

Senator DURBIN. Thank you.

Senator Shelby, ranking member of the full committee?

Senator SHELBY. Thank you. I would just like to say that I look forward to hearing from the witnesses.

Senator DURBIN. Thank you very much.

I will say to the members of the panel, your full statements, obviously, will be included in the record.

Let me start off by recognizing Mr. McGinn to proceed.

SUMMARY STATEMENT OF DENNIS MC GINN

Mr. MCGINN. Thank you, Mr. Chairman, Senator Cochran, Senator Shelby. Thank you for having us over to talk about these two critical topics. They are foremost on the minds of many in the Department of Defense and all of the services.

From our Nation's infancy, the United States Navy and Marine Corps team have embraced innovation. We have repeatedly improved on warfighting capability with better ship design, better weapons, tactics, and also more effective forms of energy.

Our transition years ago, hundreds of years ago, from sail to coal, coal to oil, and then the addition of nuclear power, gave us

all a competitive advantage on the high seas. Recent efforts at reducing consumption through energy conservation and diversifying our sources of energy are also intended to improve our ability to maintain forward presence on the critical sea lanes of the world.

ALTERNATIVE FUELS

Our operational energy program is focused on providing operational commanders with choices to include greater range, greater endurance, and greater payload while reducing their vulnerability.

An example, USS *Makin Island*, LHD 8, is an example of Navy efforts to be a more effective force. Through the use of more efficient auxiliary propulsion systems, *Makin Island* consumed 4 million fewer gallons of fuel than anticipated during her maiden voyage in 2012. That was 4 million gallons we never had to deliver to the ship while they accomplished every mission assigned.

Building on this success, we look forward to USS *America* joining the fleet this fall with the same type of propulsion system.

Recently, I had the opportunity to attend great energy training events in major fleet concentration areas, San Diego, Norfolk, Camp Pendleton, Camp Lejeune. These young warriors get it. They understand that the fuel they need for operations can provide opportunity for the enemy, so they support our efforts to find new ways to operate the equipment we have, to get more fight with less fuel.

Those efforts include the U.S. Marine Corps' Experimental Forward Operating Base, or ExFOB, which was just recently concluded last week—and I attended that out at Camp Pendleton—where industry sets up their equipment at the ExFOB for our marines to actually use and test in field conditions that will move us closer to the Commandant's vision of a Marine Corps that only uses liquid fuel for mobility on the battlefield and not for power.

Our efforts to develop drop-in alternative fuels are another critical piece of maintaining our advantage. Buying domestically produced alternative fuel allows us to reduce the uncertainties connected to the global supply chain and also insulates us against price volatility and price rise in years to come.

We are working with industry on improving the domestic alternative fuels supply chain. Through the Defense Production Act, there is a potential for up to four companies to collectively produce more than 160 million gallons of drop-in alternative fuels annually at a weighted average price of less than \$3.50 per gallon.

And on the demand side, our Farm-to-Fleet program will allow us to start integrating those advanced alternative fuels into our normal supply chains starting next year, in 2015, at a cost competitive with petroleum.

PREPARED STATEMENT

I look forward to discussing our progress in creating a new energy ethos across our forces through a combination of technology, partnerships, and culture.

Thank you for the opportunity to testify before you today, and I welcome your questions.

[The statement follows:]

PREPARED STATEMENT OF HON. DENNIS V. MCGINN

Chairman Durbin, Vice Chairman Cochran, members of the subcommittee; thank you for the opportunity to discuss the Department of the Navy's (DON) operational energy program and review the progress of the Advanced Drop-In Biofuels program.

I also appreciate the subcommittee's continued support of the men and women in uniform and our civilian workforce and their families. These men and women serve their Nation around the world with skill and dedication, no matter the hardships they face.

The Navy has a long, proud history of energy innovation; and it is no different today. Throughout his tenure, Secretary of the Navy Ray Mabus has made power and energy a top priority. In 2009, he announced five energy goals for the Department of the Navy to improve our energy security, increase our strategic independence, and improve our warfighting capabilities. The Department of the Navy is committed to generating one-half of its energy needs from non-fossil fuel sources by 2020. Over these past 5 years, we have made real progress toward those goals through greater energy efficiency and alternative fuel initiatives.

The wars in Iraq and Afghanistan have proven that energy is, and will continue to be, a national security issue. Each \$1 increase in the price of a barrel of oil results in a \$30 million bill for the Navy and the Marine Corps. These are the same dollars that provide for the operational readiness of our forces and we cannot afford to divert scarce resources in post-Budget Control Act fiscal environment.

As you are well aware, President Obama directed the Department of the Navy to work with the Departments of Energy and Agriculture to promote a national biofuel industry. This year, under authority in Title III of the Defense Production Act (DPA), these three agencies plan to complete a Department of Defense (DOD) DPA award to up to four companies to produce up to 160 million gallons of drop-in biofuels each year at a weighted average price of less than \$3.50 per gallon. This price will be competitive with what we are paying today for conventional fuels—this is aligned with DOD policy that operational quantities of biofuels must be cost competitive.

The Farm-to-Fleet Program pairs DON and U.S. Department of Agriculture (USDA) to begin integration of JP-5 and F-76 biofuels blend purchases as part of the Defense Logistics Agency (DLA) Energy's regular bulk fuel acquisitions process. USDA Commodity Credit Corporation (CCC) funds are also available to support the effort. This will mark the start of the "new normal", where drop-in biofuels will be fully integrated with our regular operations and logistics.

The program will begin with the 2014 Inland/East/Gulf Coast bulk fuels solicitation that will begin deliveries in mid-2015. This will be followed by the 2014 Rocky Mountain/West Coast program which will also begin deliveries in 2015. The Navy's requirement will stipulate that biofuels or other advanced alternative fuels comprise from 10 percent up to 50 percent of the total JP-5 and F-76 volume to be acquired. We anticipate the total volume of alternative fuels acquired through these contracts would be approximately 80 million gallons at the 10 percent alternative fuel blend.

The use of CCC funds will be available to defray premiums to conventional fuels (if any) for biofuels whose feedstocks meet the Farm Bill definition of "renewable biomass" and are grown in the United States, its territories, and protectorates.

In addition to our partnership with other Federal Agencies, we have also been working with our allies and strategic partners. We have signed Statements of Cooperation with both the Australian and Italian Navies to share biofuel specifications, research outcomes, and certification documentation. These actions will ensure the interoperability of all fuel types used among our allied partners.

We continue to develop energy efficiency through research and development of more efficient propulsion systems. The USS Makin Island (LHD 8), during its maiden deployment in 2012, saved more than four million gallons of fuel resulting in an estimated cost savings in excess of \$15 million. The Marine Corps' development of expeditionary power solutions, through the Experimental Forward Operating Base or ExFOB, has allowed them to lighten their load and be more agile warriors.

Finally, during the past month and a half, I have attended energy training events at Marine Corps Bases Camp Lejeune and Camp Pendleton, and Naval Stations Norfolk and San Diego. And our Sailors and Marines get it. They understand that these programs are about diversifying fuel supplies, stabilizing fuel costs, and reducing our overall energy needs. They get that reducing our energy consumption translates into greater combat capability. And, they are ready to respond, whenever our Nation calls upon them.

I thank you for the opportunity to testify before you today and I look forward to your questions.

Senator DURBIN. Thank you, Secretary McGinn.
Secretary Morehouse, you may proceed.

STATEMENT OF EDWARD THOMAS MOREHOUSE, JR., PRINCIPAL DEPUTY ASSISTANT SECRETARY OF DEFENSE, OPERATIONAL ENERGY PLANS AND PROGRAMS OUSD, AT&L

Mr. MOREHOUSE. Chairman Durbin, Senator Cochran, Senator Shelby, thank you for the opportunity to appear before you this morning and to talk about the operational energy program at the Department.

I would like to start by recognizing my predecessor, Sharon Burke, for the indelible imprint she has left on the Department and our office, and I hope to continue her success.

ENERGY

I thought I would start by giving you a short overview of operational energy. The Department is the single largest user of energy in the country, about \$20 billion per year. Operational energy is the energy we use to acquire, to train, to move, to sustain forces and platforms for military operations. It is about 75 percent of that total.

The energy in liquid fuels and batteries is the lifeblood of the military. It powers our vehicles, our ships, our aircraft, our generators, our bases, and our dismounted warriors. The bottom line is energy is a critical mission enabler.

If you take away one thing from my testimony today, I hope it is this: That the goal of our office is to strengthen our military capabilities by improving how we use energy in the field, particularly reducing the burdens and risks from our energy supply lines.

Using energy more wisely will enable us to fly and sail farther, to loiter or remain on station longer, and give us supply lines that are more secure, requiring fewer forces and fewer lives and less money to sustain.

Energy is likely to be an even bigger concern as we rebalance to the Asia-Pacific. Vast distances, increased logistical challenges, and potential adversaries are likely to have more formidable capabilities to target us with more precision and a longer range, putting our supply lines at greater risk to attack.

In fiscal year 2015, the Department estimates it will consume about 96 million barrels of fuel at a cost of about \$15 billion. In fiscal year 2015, we are also going to invest \$1.7 billion in initiatives to improve how we consume that energy for military operations and about \$9 billion across the FYDP (Future Years Defense Program).

Ninety-two percent of that investment goes to improving the energy performance of our weapons and our military forces. This includes procurement programs such as the Army's efficient generator program, and innovative efforts such as engine programs for fighter aircraft and for helicopters.

Eight percent of the investment goes into diversifying and securing our supplies of operational energy. This includes, for example, the Marine Corps' program to procure tactical solar generation and recharging systems for batteries.

Supporting these investments are increased efforts to develop better analytic tools that will allow us to better understand how energy affects our strategies, our plans, our requirements, and our acquisition processes.

And we have made a great deal of progress. With energy and energy logistics now being incorporated into major wargames, and a mandatory performance parameter into our requirements development process, our understanding of how energy affects our operations is deepening.

In addition to the focus on future force, the office continues to promote operational energy innovation through our own science and technology investments. We will also continue to examine how global energy dynamics affect national security and shape our defense missions.

PREPARED STATEMENT

We will continue to use our oversight and budget certification authority to share information and insights across the services, and encourage consideration of operational energy throughout the Department's decisionmaking processes.

Finally, we will continue to support deployed forces with energy solutions ranging from rapid fielding of new technologies to adapting war plans to incorporating energy into international partnerships, and by gathering and applying those lessons we have learned from Afghanistan.

Thank you for your time, and I look forward to your questions.
[The statement follows:]

PREPARED STATEMENT OF EDWARD THOMAS MOREHOUSE, JR.

INTRODUCTION

Chairman Durbin, Vice Chairman Cochran, and distinguished members of the subcommittee, thank you for the opportunity to discuss my office in the Department of Defense, Operational Energy Plans and Programs (OEPP). Today, the Department faces continued operational energy challenges as our defense posture adjusts to meet the rapidly-changing global security environment. The dynamic global energy landscape adds to our strategic challenges and opportunities. I will provide some perspective on those issues, along with an update of our progress and some information on the President's fiscal year 2015 Budget Request as it relates to operational energy.

MISSION OF OEPP

Established in 2010, my office's primary purpose is to strengthen the energy security of U.S. military operations. Specifically, the office's mission is to help the Military Services and Combatant Commands improve military capabilities, cut costs, and lower operational and strategic risk through better energy planning, management, and innovation. By statute, operational energy is defined as the energy required for training, moving, and sustaining military forces and weapons platforms for military operations. In June 2011, the Department released "Energy for the Warfighter: The Department of Defense Operational Energy Strategy," which set the overall direction for energy use in the Department: to assure reliable supplies of energy for 21st century military operations. It outlines three ways to meet that goal: reducing the demand for energy; expanding and securing the supply of energy; and building energy security into the future force.

These goals are especially important as we build a military force that is prepared and postured for a complex, global security environment, "capable of simultaneously defending the homeland; conducting sustained, distributed counterterrorist operations; and in multiple regions, deterring aggression and assuring allies through forward presence and engagement," as the Secretary of Defense called for in the 2014 Quadrennial Defense Review (QDR). The QDR also directly connects energy to capa-

bility, noting that, “Energy improvements enhance range, endurance, and agility, particularly in the future security environment where logistics may be constrained.” To these ends, OEPP has achieved considerable progress by supporting current operations and energy innovation, building operational energy considerations into the future force, and promoting institutional change within the Department.

CHANGING ENERGY LANDSCAPE

DOD’s efforts to transform our own energy use are occurring as the global energy landscape rapidly changes. Here at home, the significant surge of domestic oil and gas production is fundamentally altering the balance of the energy markets we have known for the past 40 years. The United States is expected to become the world’s largest producer of natural gas; around the country, massive terminals built to import natural gas are now rapidly being converted to export it.¹ Oil imports have been reduced by about 2.5 million barrels a day in just the last 5 years² while U.S. production is expected to increase by a further 3 million barrels per day by the end of the decade.³ The United States now exports around 3 million barrels per day of refined product, an increase of more than 2 million barrels per day since 2005.⁴

This rebalance is significantly altering the flow of the global energy trade. Energy shipments from West Africa that used to cross the Atlantic are now headed to Europe or through the Indian Ocean en route to Asia. Permits to export natural gas are now being approved and by the end of the decade we can expect U.S. natural gas to be available for markets in Europe and Asia. It is not just the supply patterns that are changing. Energy demand in the developed world has leveled off. The majority of the growth in the world’s energy consumption over the next decade will come from the developing world with China, India, and other non-Organization for Economic Co-operation and Development countries increasing their energy consumption by 50 percent in the next 20 years.⁵

As regions which have previously exported to the United States redirect their energy products to new customers, our economic, political, and military relationships with those countries will evolve as well. As the Department considers base access, security cooperation and partnerships, we must be cognizant of these changing underlying economic forces.

We also see how the appearance of new energy resources is influencing the Department’s strategic direction. Last year, Secretary of Defense Chuck Hagel unveiled DOD’s first-ever Arctic Strategy and addressed the driving force behind it—global climate change. According to the U.S. Navy’s Task Force Climate Change, “average Arctic temperatures have increased at almost twice the global average rate” in the past 100 years, and “in 2012, Arctic sea ice reached its smallest extent in recorded history, 1.3 million square miles.” The changes in that region have opened up new areas to energy development and shipping. As the Arctic region becomes more accessible to other nations, expanded capabilities and capacity may be required to increase U.S. engagement in this region.

Changes in the climate, driven by global energy use, will affect military operations elsewhere as well. Specifically, as the 2014 QDR found, climate change can act as threat multiplier, as heat waves, drought, floods, and severe storms may significantly add to the associated challenges of instability, hunger, poverty, and even conflict. At the installation level, climate risks may disrupt training, testing, and direct support to ongoing operations. In fact, the National Intelligence Council estimates over 30 U.S. military installations face elevated risks from rising sea levels. In the cases of severe weather events, demands on the Department for humanitarian assistance or disaster response—both within the United States and abroad—may increase as the climate changes.

However, even with all these changes, some constants remain. First, it is important to point out that most of the Department’s operations occur outside the United States, and we will continue to buy energy overseas to simplify our supply chains, limit costs, and increase flexibility for the warfighter. Second, a large proportion of

¹ <http://www.eia.gov/todayinenergy/detail.cfm?id=13251>.

² <http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=p&s=wcrim2&f=w>.

³ http://www.eia.gov/forecasts/aeo/er/early_production.cfm, EIA Annual Energy Outlook, Early Release Overview, “U.S. production of crude oil (including lease condensate) in the AEO2014 Reference case increases from 6.5 MM bbl/d in 2012 to 9.6 MM bbl/d in 2019.”

⁴ <http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=P&s=MTPEXUS2&f=M>, EIA data on U.S. exports of finished petroleum products indicates monthly U.S. exports of finished petroleum products in November 2013 was 3 million bbls/d compared to 811,000 bbls/d in November 2005.

⁵ <http://www.eia.gov/forecasts/ieo/world.cfm>—According to EIA, non OECD countries consumption will rise from 307 quadrillion BTUs in 2013 to 460 by 2030.

global energy will continue to flow through a relatively small number of chokepoints. Today, nearly a fifth of all oil and nearly 25 percent of globally traded liquefied natural gas transit the Strait of Hormuz. Current and planned pipelines across the Arabian Peninsula and around the Strait would provide only limited relief in the event of a blockage and would do little to cushion any global price spike. The Strait of Hormuz will continue to pose an outsize risk to global prices for the foreseeable future—and to prices at the pump here at home.

Indeed, the Middle East will remain a major source of oil for nations across the globe, particularly our allies in Asia. Even so, the 2014 QDR states that “competition for resources, including energy and water, will worsen tensions in the coming years and could escalate regional confrontations into broader conflicts—particularly in fragile states” in the Middle East. As long as petroleum powers our transportation sector, we will experience the economic consequences of price volatility from events in any oil-producing region. At the United Nations General Assembly this past September, the President made clear that the United States will continue to ensure the free flow of energy from the Middle East to the world, even as the United States steadily reduces our dependence on imported oil. It is important to remember that even as the United States is able to meet more of our energy needs ourselves, the price for oil and petroleum products will still be set by a global market.

THE DEFENSE ENERGY CHALLENGE—TODAY AND TOMORROW

As a critical enabler for military operations, the Department consumes significant amounts of energy executing missions around the globe. While only accounting for approximately 1.3 percent of U.S. oil and petroleum consumption in fiscal year 2013, the Department is the single largest energy user in the Nation. In fiscal year 2013, the Department consumed almost 90 million barrels of liquid fuel at a cost of \$14.8 billion, with more than 60 percent of that outside of the United States. In fiscal year 2014, the Department estimates it will consume nearly 105 million barrels of liquid fuels at a cost of \$16 billion. In fiscal year 2015, the Department estimates it will consume 96 million barrels of liquid fuel at a cost of approximately \$15 billion.

The Department’s demand for operational energy varies according to the missions assigned to the Department, as well as the equipment used in to execute those missions. Including training, exercises, and the full range of military operations, the Department uses operational energy to maintain readiness and deploy, employ and sustain forces around the globe. Year over year, operations tempo reflects unexpected demands (i.e., post-9/11 operations, humanitarian relief missions) as well as changes in the magnitude of other ongoing operations like Afghanistan.

In Afghanistan, the Department used more than 9 million barrels of liquid fuels to support Operation Enduring Freedom in fiscal year 2013. In addition to the fuel provided to vehicles and aircraft, the demand for electricity on the battlefield has steadily increased over years of sustained combat operations. Combat outposts and forward operating bases are the hubs for our troops—to project power from, fight from, and live in. However, they consume tremendous amounts of energy and have, therefore, been a steady focus of recent efficiency efforts.

The reliance on diesel generators to supply battlefield and contingency base electrical power produces an unintended consequence—a growing energy sustainment burden that must be sourced, in many cases, from great distances. Unfortunately, that logistics effort consumes fuel as well. The two main fuel distribution routes into Afghanistan present daunting challenges that range from the political effort needed to sustain them, to long distance transport on unimproved roads with multiple choke points and poor weather conditions which can slow movement to a trickle, and the threat of attack from insurgents or thieves. Each of these challenges adds time, manpower, and cost to the supply process. Once the fuel reaches larger distribution points inside Afghanistan, it still needs to be deployed to a nationwide network of bases and outposts. Given the terrain and the threat, aerial distribution of supplies, including fuel, is often used to sustain coalition efforts across Afghanistan. Delivering all of this fuel takes a toll on aircraft, vehicles, and personnel. Looking further back in the supply chain, DOD has depended on political support from countries that allow our energy supplies to flow into Afghanistan through northern or southern transportation routes, which can be disrupted at any time.

The growing requirement for troop-borne capability has launched another sustainment burden—portable batteries—which represents a serious logistical challenge for the warfighter as our troops are increasingly overburdened platforms themselves. They carry gear which sends and receives data from remotely powered aircraft and far-away command posts, and integrates the information into intelligence collection, surveillance, and targeting like never before. Soldiers and Marines have scopes, sights, and radios that give them unsurpassed awareness and ac-

curacy. But, this capability requires a steady supply of power, and for dismounted operations that means batteries, and lots of them. Consider an Army estimate that an average troop on a three-day patrol may carry up to 23 batteries weighing nearly 14 pounds. While these batteries support important capabilities, the trend of increasing weight is unsustainable from both resupply and soldier loading perspectives. Battery resupply requirements can greatly diminish a patrol's combat radius, and soldier-carried weight already impedes mobility on the battlefield and presents a significant risk of musculoskeletal injuries.

These fuel and battery requirements also place a significant logistics burden on planners, troops, equipment, and supply lines. Reducing the demand for energy on the battlefield has a direct effect on reducing the energy logistics burden and freeing up manpower and equipment resources previously engaged in logistics tasks to operational commanders for use in generating combat power.

As we draw down forces from ongoing operations in Afghanistan and adapt to a changing security environment, the Department's use of energy will continue to be of great importance. Generally speaking, our future operating environment will include a range of threats—from homemade improvised explosive devices (IEDs) and suicide bombers to GPS-guided mines and missiles, computer viruses, and electronic warfare—that may not only characterize actual combat, but also situations short of war. At the same time, the lessons of the last 12 years have not been lost on our potential adversaries, who are increasingly developing or acquiring capabilities that threaten our ability to project and sustain this power. These asymmetric and “anti-access/area-denial” capabilities will likely target those U.S. capabilities that may be more susceptible to disruption, such as logistics, energy, and command and control.

More specifically, the President and the Secretary have emphasized that we shift our strategic focus to the Asia Pacific, a region whose security and prosperity is indispensable to our own. Promoting our interests in the area—and much of that will focus on non-military tools—means long distances, far from our own shores. For example, intra-theater lift in Afghanistan requires a fraction of the fuel that will be required for intra-theater lift in the Pacific. A cargo plane flying from Bagram to Kandahar burns around 3,000 gallons of fuel, but that same aircraft will burn around 11,500 gallons of fuel flying from Guam to Seoul and over 16,000 gallons flying from Guam to Singapore. In this environment, demands for fuel, electricity, and energy logistics—aerial refuelers and oilers, for instance—can become a limiting factor for military operations. Not only will we need extended range and endurance to operate—whether for today's relief missions in the Philippines or for other military missions—but we also will need to be interoperable with our allies and partners from an energy and logistics perspective to effectively carry out coalition operations. In fact, energy can be a positive tool for cooperating with emerging partners to help support U.S. presence and operations with U.S. forces.

REDUCING DEMAND

Increasing combat effectiveness in current operations through reductions in fuel demand has been a significant DOD focus since OEPP's establishment in 2010. To quote the former International Security Assistance Force/U.S. Forces-Afghanistan Commander General John Allen, “Operational energy equates exactly to operational capability.”⁶ We aspire to achieve the most “mission per gallon” by reducing the demand for energy and decreasing the logistics effort necessary to support the warfighters. The Department has made progress, particularly at the tactical edge where fuel logistics cost the most and resupply risks are the greatest. However, DOD's fuel demand still accounts for a large percentage of the overall logistics burden and many opportunities remain to build a more efficient future force. In general, this is a huge incentive for improving our materiel capabilities and is reflected in the \$1.7 billion in fiscal year 2015 and \$8.3 billion across the Future Years Defense Program that the Services have budgeted for operational energy initiatives and efficiency improvements. That equates to almost 92 percent of the OE-related budget invested in reducing the demand for energy.

Let me sketch out some key activities to highlight the OEPP's efforts in partnership with the Combatant Commanders.

US Central Command (USCENTCOM)

The Operational Energy Division (OED) within the Joint Program Integration Office at U.S. Forces-Afghanistan (USFOR-A) was established in 2011 with a mandate to improve operational capabilities and warfighter effectiveness by reducing our

⁶ISAF/USFOR-A memo, “Supporting the Mission with Operational Energy,” 11 December 2011.

forces' reliance on liquid fuels. Staffed with technical experts, the OED continues to develop and implement materiel and non-materiel energy solutions to reduce dependence on petroleum fuels and increase operational effectiveness. OED coordinates directly with OEPP, and we maintain a close relationship to address operational energy issues and initiatives in theater. In 2012, OEPP and OED combined efforts with the Army's Program Manager-Mobile Electric Power (PM-MEP) to answer an Operational Needs Statement with \$110 million worth of advanced, energy efficient power generation and distribution equipment. OED and OEPP also collaborated to fund and support an operational demonstration of an advanced tactical microgrid to gather data for future microgrid technology development.

This past year, OED also provided significant support to Operation DYNAMO. Improvements in energy efficiency produce the greatest leverage at the extreme tactical edge, since the risks and costs to provision fuel there are so great and potentially so disruptive to the operational mission. In a tactical environment, electrical demand has usually been met by multiple diesel-powered generators, sized for peak loads but often operating far from peak capacity and efficiency. The consequence of poor generator loading is significant fuel waste, increased maintenance effort, and decreased reliability. In an attempt to address those issues, PM-MEP, in coordination with USFOR-A OED, recently completed Operation DYNAMO I and II, which assessed the electrical supply and demand footprint at 67 forward operating locations. Mission-specific advisory teams developed more efficient power generation and distribution plans, replaced older equipment with more than 500 fuel efficient Advanced Medium Mobile Power System generators and 430 Improved Environmental Control Units, updated distribution systems to improve reliability and safety, and trained local soldiers to operate and maintain the equipment properly. This effort spotlights the value of OE advisors teamed with expert technicians and military standard equipment and their ability to become a significant combat force multiplier for operational commanders. Building on the success of its predecessors, Operation DYNAMO III is underway now to oversee the right sizing of power assets during the drawdown in Afghanistan to ensure that as we reduce our forces we continue to apply the lessons we have learned.

US Pacific Command (USPACOM)

OEPP has embraced emergent energy challenges in the Pacific and partnered with USPACOM and other key stakeholders to understand and address them.

The vast expanse of the oceans and seas that comprise USPACOM's Area of Responsibility put a premium on the ability of maritime forces to foster relations with partner nations, protect commercial and military shipping, and execute offensive operations on and from the sea. The Navy is exploring many technologies, such as Hybrid Electric Drive, stern flaps and improvements to marine-growth reducing hull and propeller coatings, to reduce fuel consumption. The Naval Postgraduate School-developed Replenishment at Sea Planner is great example of an inexpensive, in-house software solution to reduce our logistics burden. It is intended to optimize logistical transit plans and the fuel necessary for both warships and military sealift logistics vessels to prepare for and execute underway replenishment. This software tool is already in use in Fifth and Seventh Fleets and is expected to save millions of dollars in fuel costs each year.

OEPP remains engaged in the Department's ongoing efforts to improve liquid fuel delivery ashore in areas where little to no distribution infrastructure exists. In April 2013, my predecessor attended the Joint Logistics Over-The-Shore demonstration in Korea. This recurring, combined U.S./Republic of Korea event exercises our ability to deliver fuel, supplies and equipment from ships at sea to encampments ashore where sufficient maritime port facilities do not exist. We have impressive over-the-shore fuel distribution capabilities, and yet they may be stressed in some scenarios. I am pleased that the Navy has programmed \$34 million between fiscal year 13-17 to fund a replacement for an aging Offshore Petroleum Discharge System ship the USS Petersburg, while the Army develops the next generation of Inland Petroleum Distribution System. Each Service needs to continue to ensure that this capability can meet current and future operational requirements.

As the DOD operational energy strategy has evolved, OEPP and the Combatant Commanders have expanded our efforts beyond improving only U.S. force capabilities. Teaming with partner nations to improve fuel efficiency and reduce energy demand across our combined forces benefits global cooperation and our combined security in the region. To that end, my office is currently exploring options within the Asia-Pacific region to identify and assess low-cost, high-payoff operational energy-related security cooperation opportunities that could contribute to broader U.S. and Asia-Pacific partner policy objectives. The results are intended to inform future guidance to inform USPACOM planning guidance, and to build partnership capacity

activities for USPACOM, the Joint Staff, the Office of the Secretary of Defense (OSD), and interagency partners. Additionally, ongoing contingency basing energy technology demonstrations and experimentation events during joint and combined exercises, such as CRIMSON VIPER in Thailand and BALIKATAN in the Philippines, are improving our own capabilities and those of key partner nations through focused military-to-military engagements.

US Africa Command (AFRICOM)

In the US Africa Command area of responsibility, OEPP is mentoring a growing and effective headquarters staff effort to incorporate operational energy across their operations and theater security cooperation activities. The staff recently assigned its first dedicated operational energy advisor and, in addition, continues to benefit from a Department of Energy (DOE) employee serving as a liaison to advise the commander on energy issues. Additionally, my office supported the establishment of the governance structure for the command's Interagency Energy Security and Environment Working Group which considers operational energy equities in operations and exercises.

As the United States increases its focus on the African continent, the Department is similarly stepping up its efforts to support the Combatant Commander across a range of operational energy issues. The austere operating environment is compounded by the lack of infrastructure which introduces a challenging sustainment picture. The Army's Rapid Equipping Force recently conducted an energy assessment of remote and urban locations supporting U.S. forces across the Trans-Sahara region to help them increase electrical power generation, improve electrical safety, and increase drinking water production and safety. The Naval Facilities Engineering Command, in coordination with the National Renewable Energy Laboratory, completed an energy assessment at Camp Lemonnier, Djibouti. Camp Lemonnier, though an enduring site and under the responsibility of the Office of the Deputy Under Secretary of Defense for Installations and Environment (ODUSD(I&E)), contains some equipment more typical of contingency locations, so OEPP collaborated with the ODUSD(I&E) on energy issues at the Camp by identifying peak electrical load requirements and analyzing the energy demand impact of several new environmental control system configurations. In addition, my office recently partnered with the U.S. Agency for International Development to exchange information, establish a working forum, and begin leveraging DOD lessons learned in Afghanistan to assist the Power Africa initiative in its mission to improve power distribution to rural villages and towns.

In general, as part of my office's focus on contingency basing, we recently helped identify measures in CENTCOM, SOUTHCOM, and AFRICOM to reduce fuel demand in contingency plans and to determine the potential operational value of that fuel demand reduction. Employing improved power generation equipment and shelter construction standards, and future fuel efficiency improvements to aerial resupply vehicles, will help operational commanders optimize in-theater fuel resupply plans as part of larger contingency planning efforts.

Operational Energy Capability Improvement Fund

My office is also supporting longer term innovation and change via the Operational Energy Capability Improvement Fund (OECIF). The OECIF began in fiscal year 2012 with the goal of funding innovation that will improve the operational energy performance of our forces while creating institutional change within the Department. It promotes partnering and joint programs and encourages Service teaming. The programs started in fiscal year 2012 have concentrated on reducing the energy load of our expeditionary outposts. For example, there is a joint Army/Air Force program developing ways to improve the energy efficiency of soft shelters (i.e. tents), which has demonstrated improved tents and camp architectures in Kuwait, resulting in a 50 percent reduction in power consumption. Another program demonstrated a 54 percent reduction of the energy needed to cool hard shelters (i.e. containerized living units) used in Djibouti, Africa. In fiscal year 2012, OECIF also started a program to demonstrate and evaluate load reduction technologies for expeditionary outposts in tropical environments—something particularly suited to our shift to the Pacific environment. By combining upgraded environmental control units (ECUs) with light emitting diode (LED) lighting and hybrid automatic/manual controls, energy savings as high as 80 percent over earlier technologies have been demonstrated. The OECIF is also supporting the development of technology for more efficient ECUs, which heat and cool our deployed shelters and consume a great deal of energy, including through a partnership between the Navy and the Department of Energy's Advanced Research Projects Agency for Energy (ARPA-E).

The OECIF programs begun during fiscal year 2013 emphasized establishing entities aimed at involving a wide variety of organizations in solving our operational energy problems. OEPP encouraged the use of innovative business methods, such as consortia, to involve small businesses and non-traditional defense contractors. For example, one of these programs, led by the Army, is focused on energy for our dismounted warfighters. Our soldiers and Marines benefit from the world's most technologically advanced weaponry; however, this equipment can require that a warfighter carry around 14 pounds of batteries on lengthy patrols. The Army-led OECIF program is meant to comprehensively address this problem through developing better system engineering techniques and technologies to improve both the energy demand and supply in order to reduce the weight burden. Other programs begun in fiscal year 2013 are developing standards for tactical microgrids to promote their interoperability and adoption, developing planning methods and control technologies for designing and running more efficient expeditionary outposts, and engineering surface coatings to reduce aircraft drag.

Most recently, for fiscal year 2014, OECIF is pursuing new programs to develop the analytic methods and tools necessary to support the thorough analysis and consideration of operational energy issues throughout DOD's various planning and management processes. The basic idea is to give decision makers within the Department better ways to factor operational energy into their decisions. This focus was based on our experience in the last few years and on observations made during our budget certification process, where we found challenges to the ability of the Department to consider energy in its decisions. We are using the OECIF to help solve it, which is consistent with its goal of creating institutional change.

INCREASE/ASSURE SUPPLY

Another element of our strategy is diversifying and securing military energy supplies to improve the ability of our forces to get the energy they require to perform their missions.

Alternative Energy and Fuels

The Department's operational energy investments are focused on meeting warfighter needs, including by diversifying the Department's supply options. One focus is on energy that can be generated or procured locally near deployments to lessen the burden on supply lines. The Services are evaluating, and, where appropriate, deploying tactical solar technologies to generate electricity on contingency bases or to recharge batteries to increase patrol range and mission duration. OEPP is assisting in these efforts by coordinating information sharing amongst the Services and between the Services and DOE, which has broad technical expertise in civilian solar technologies. Additionally, the Department is funding research in deployable waste-to-energy systems that could reduce the volume of waste requiring disposal and produce energy for contingency bases. Other technologies in which the Department is investing include hydrogen-powered and solar-powered unmanned aerial vehicles, which have the potential to achieve much longer mission durations than those powered by traditional petroleum-based products.

Another component of the Department's operational energy strategy is alternative fuels. As the Nation's largest consumer of energy, the Department recognizes that our military will need alternatives to petroleum to diversify sources of supply. Over the long term, the Department will need fuels derived from various feedstocks that are cost-competitive, widely available around the world, and compatible with existing equipment and storage infrastructure, as our existing fleet of ships, planes, and combat vehicles will be with us for decades to come. So the Department is investing around 2 percent of its operational energy funding over the next 5 years on alternative fuels. The Services are focusing the majority of their alternative fuels efforts on certifying aircraft, ships, tactical vehicles, and support equipment to use these emerging fuels, as they have been doing since 2006. These initiatives improve the flexibility of military operations by ensuring that our equipment can operate on a wide range of fuels when they are cost-competitive and commercially available.

To create clear guidelines on the Department's alternative fuels investments both now and in the future, on July 5, 2012, the Department of Defense Alternative Fuels Policy for Operational Platforms was released, pursuant to Section 314 of the National Defense Authorization Act of 2012. The policy establishes coordinated, Department-wide rules to guide and streamline its investments in the development and use of alternative fuels. The policy states that the Department's primary alternative fuels goal is to ensure operational military readiness, improve battlespace effectiveness, and further the flexibility of military operations through the ability to use multiple, reliable fuel sources. All Department investments in this area are re-

viewed during the Department's annual operational energy budget certification process.

To date, the Department has only purchased test quantities of biofuels for testing and certification purposes. These test fuels are often more expensive than commercially-available petroleum fuels because they tend to be produced at small, not-yet-commercial-scale facilities using novel conversion technologies. However, the policy formalized what was already the practice for all the Military Services: the Department will not make bulk purchases of alternative drop-in replacement fuels unless they are cost competitive with traditional petroleum products. With this policy in place, the Department will continue to steward its alternative fuels investments towards the ultimate goal of enhancing the long-term readiness and capability of our joint force.

Because the Department does have long-lived platforms designed to use liquid fuels, there is a long-term defense interest in fuels diversification. The Department also supports a larger national goal to promote the development of low-carbon, renewable fuels. The Defense Production Act (DPA) advanced drop-in biofuels production project, led by the OSD Manufacturing and Industrial Base Policy Office, is a Department of Defense partnership with the private sector and the Departments of Energy and Agriculture, which have the lead roles for the Federal Government for biofuel feedstocks and production. This project works to accelerate the production of cost-competitive advanced alternative fuels for both the military and commercial transportation sectors. The fiscal year 2012 DPA funding for Phase 1 was awarded to four companies in May/June 2013 and is being used for competitive commercial-scale integrated biorefinery design efforts. Awards totaled \$20.5 million, which was matched by \$23.5 million in private sector funds. The technical evaluations for Phase 2 proposals are complete, and in July 2014, awards of \$70 million will be made to up to four companies for the construction of drop-in biofuel production facilities.

Securing Our Energy Supplies

There is rising concern about risks to the U.S. electric grid that powers most DOD bases, ranging from cyber-attacks to hurricanes. The risks and vulnerabilities of the U.S. electric grid and overseas electricity supplies supporting DOD facilities are not well characterized. Today, military operations can include warfighters conducting missions remotely from domestic facilities; the disruption of electric power in one location could adversely affect the outcome of a battle thousands of miles away. And, in the event of a major domestic outage, as with Hurricane Sandy, the lack of adequate power could create tension between Defense support for civilians and the Department's own needs.

We recognize the need for better information and coordination on risks to the grid and are exploring the Department's role in building resiliency into the system. To that end, OEPP and the lead offices within OSD responsible for electric grid issues (i.e., ODUSD(I&E) and the Office of the Assistant Secretary of Defense for Homeland Defense and America's Security Affairs), in partnership with the Department of Homeland Security's Office of Infrastructure Protection, led an interagency, scenario-based workshop to gain a better understanding of how the Department would respond to a prolonged and widespread power outage in the National Capital Region that affected military bases and missions in the area. We continue to engage in discussions with utility service providers, Federal agencies and other DOD entities to address this challenge.

In addition to electrical power concerns we are also looking at the security of our liquid fuel supply. OEPP is currently examining logistical challenges generated by the vast distances and extensive operating areas present in the Asia-Pacific theater. My office is working with the Defense Logistics Agency and the Joint Staff in studying nodes and transportation links to support modifications to the Global Petroleum Distribution System.

BUILDING ENERGY SECURITY INTO THE FUTURE FORCE

The Department continues to make strides in improving energy security for the future force. We have invested a significant amount into the development and deployment of operational energy initiatives to increase the combat effectiveness of our warfighters. Programs of note include the:

- Adaptive Engine Technology Development (AETD) program—AETD is focused on developing a "sixth-generation" fighter engine with better fuel-burn rates. At the core of the program is a move to a design with three streams of air, allowing more flexibility for the engine to operate efficiently under varying conditions. AETD's goal is to provide 25 percent greater fuel efficiency which will increase range and endurance of fighter aircraft and decrease the requirement for tanker

aircraft to support AETD-equipped aircraft. The Department recently announced a follow on program, the Advanced Engine Technology Program, to carry the engine through technology maturity risk reduction.

- Improved Turbine Engine Program (ITEP) program—This program provides an improved engine for the Apache and Blackhawk helicopter fleets to replace the current T-700 engine. ITEP will improve operational effectiveness by giving commanders an improved aviation fleet with longer loiter time, increased altitude limits, increased payload and lower fuel and maintenance costs. The Army expects a 25 percent fuel reduction from current engine consumption levels.
- Hybrid Electric Drive (HED) program—The Navy will begin installing HEDs in Arleigh Burke-class (DDG 51) destroyers in 2016. HED is an electric motor attached to the main reduction gear of DDG-51-class ships to provide low speed propulsion, resulting in improved fuel economy and longer time on station. Installation of an HED on a single ship has the potential to save over 5,000 barrels of fuel per year, which equates to approximately a 7 percent reduction from current usage or 11 additional underway days each year, and provides our commanders at sea improved operational flexibility.
- Medium Tactical Vehicle Replacement (MTVR)—This effort includes developing and demonstrating a fuel efficiency improvement of 15 percent over the existing MTVR while maintaining affordability, mobility and survivability. Additionally, within this program, the Marine Corps funded the procurement of prototypes of the On-Board Vehicle Power sources to reduce fuel requirements at idle, which is the majority of the vehicle drive cycle.

We have worked with the Joint Staff and the Services to implement the Energy Key Performance Parameter (eKPP) or energy Key Support Attribute (eKSA) across all acquisition categories. This includes Acquisition Category I programs such as the Armored Multipurpose Vehicle, Joint Light Tactical Vehicle, DDG-51 Flight III and the Air Missile Defense Radar, along with smaller acquisition programs such as the Medium Tactical Vehicle Replacement, Prime Power Mobile Production System, and the Force Provider—Expeditionary Program. The eKPP and supporting analyses are included in the Chairman of the Joint Chief of Staff (CJCS) Instruction and the Joint Capabilities Integration and Development System (JCIDS) Manual. It is a requirement for all program seeking Joint Requirements Oversight Council (JROC) approval unless a waiver is approved.

In regards to shaping the requirement and acquisition systems, the Department is working to conduct operational energy analysis earlier; that will provide a greater opportunity to consider the tradeoffs and options that would result in a more energy-secure force, more effective or efficient equipment, or a more capable force. The Joint Staff, the Service Energy Offices, and my office have worked together to make operational energy an integral part of war games and exercises. We are developing a tool to provide the war gamers timely feedback about attacks on our logistics and energy supplies. We are also working together to ensure operational energy supportability analysis is conducted during the Services' concept development, which provides a realistic energy distribution and allows simulated enemy forces to interdict our energy supplies, to more closely approximate real world conditions.

Moving forward, we must continue to fund analysis to identify which capabilities and missions to target for operational energy improvements. We have found that engaging earlier, well before Milestone A, will give us the greatest opportunity to provide greater capabilities through operational energy improvements.

INSTITUTIONALIZING OPERATIONAL ENERGY BY SHARING INFORMATION

OEPP has taken a number of tangible steps to institutionalize operational energy improvements and avoid duplication across the Services and the military establishment through the sharing of knowledge. Our Budget team regularly participates at a senior executive level in Service budget reviews, Service POM reviews, Defense Acquisition Boards, Overarching Integrated Product Teams, and Initial Integrated Product Teams. OEPP also participates in Analysis of Alternatives Senior Advisory Groups to consider energy issues early in the acquisition process. Through our annual Budget Certification process, which certifies the adequacy of the budget to the Secretary of Defense for implementing the Operational Energy Strategy, we gain visibility into Service program objectives through a detailed review of all operational energy objectives. This ensures minimal duplicative efforts. We also interact regularly with the Services, including their energy offices, the Joint Staff, and the COCOMs. We have driven the consideration of operational energy into established DOD Decision Support Processes, including Joint Capabilities Integration Development System (JCIDS) and the Defense Acquisition Planning, Programming, Budgeting, and Execution process. Our office works with USD(Policy) to ensure oper-

ational energy is included during the Planning phase and in the Defense Planning Guidance, and the Quadrennial Defense Review.

Through our DOE/DOD Memorandum of Understanding, we seek to leverage the complementary goals of DOD and DOE energy programs where it exists, and where it helps the DOD mission. We are collecting Operational Energy Lessons Learned to capture the valuable learning from forces deployed in-theater. Through the Defense Operational Energy Board (DOEB), co-chaired by the ASD(OEPP) and the Joint Staff Director of Logistics, and the Deputy DOEB, we communicate with the Services and receive Service input into our highest operational energy priorities.

Our Requirements and Analysis team participates in milestone reviews for Acquisition Category (ACAT) I programs. Just this simple action has gone a long way to increasing OEPP recognition and creating a structure for ensuring the introduction of operational energy considerations into all the major DOD weapon systems programs.

OECIF also helps institutionalize operational energy and we run it to share results across the Services. We fund innovative energy programs within the Services. We cement institutional buy-in by generally insisting that all proposals be vetted by a Service Energy Office. We also ensure the dissemination of innovation across military stovepipes by encouraging the programs to have multi-Service participation. Program reviews are also an opportunity to share research results.

INSTITUTIONALIZING OPERATIONAL ENERGY IN POLICY

In the long term, the Department must build operational energy considerations into the regular rhythm of how the Department operates. To begin with, the Secretary of Defense signed the Operational Energy Strategy Implementation Plan in March 2012 and identified seven targets:

1. Measure operational energy consumption;
2. Improve energy performance and efficiency in current operations and training;
3. Promote operational energy innovation;
4. Improve operational energy security at fixed installations;
5. Promote the development of alternative fuels;
6. Incorporate energy security considerations into requirements and acquisition; and,
7. Adapt policy, doctrine, professional military education, and Combatant Command activities to include operational energy.

The Department is making great progress implementing the strategy; further details are available in our Operational Energy Annual Report to Congress and budget certification reports, which are available on the OEPP Web site (<http://energy.defense.gov/>).

In April 2014, the Acting Deputy Secretary of Defense Christine Fox issued DOD Directive 4180.01, "DOD Energy Policy." As the Department's first overarching defense energy policy in over 20 years, this new directive provides a common energy framework to guide the full range of defense energy activities, including operational energy, facility energy, and energy-related elements of mission assurance. The directive also codifies responsibilities for implementing the energy policy across OSD, the Joint Staff, Combatant Commands, Military Departments and Defense Agencies. The directive establishes that "It is DOD policy to enhance military capability, improve energy security, and mitigate costs in its use and management of energy." In support of these overarching goals, the policy directs the DOD to adapt core business processes—including requirements, acquisition, planning, programming, budgeting, mission assurance, operations, and training—to improve the Department's use and management of energy.

The Department also issued other policies over the past year to support the operational energy mission. In January 2013, the Under Secretary of Defense for Acquisition Technology and Logistics released Department of Defense Directive 3000.10, "Contingency Basing Outside the United States." In addition to outlining Department policy related to interoperability, construction standards, and other areas, the Directive specified the role of operational energy and identified a smaller logistics footprint as enabling more effective and capable contingency bases.

In addition to the strategy, guidance, and policy set forth by my office and OSD, the Military Services have followed with their own initiatives. In the past year, the Army and the Air Force have updated their own energy strategies while the Marine Corps issued guidance for improving the incorporation of energy into their acquisition programs. Similarly, the Navy has moved out, leading the Department with efficiency upgrades to their legacy aircraft and propulsion innovations in their ships. In addition, working with OSD/Policy and the AT&L International Cooperation of-

face, we have tracked international developments in this area, and encouraged consideration of operational energy in multinational security cooperation.

CONCLUSION

In November 2013, Secretary Hagel stated, “DOD invests in energy efficiency, new technologies, and renewable energy sources at our installations and all of our operations because it makes us a stronger fighting force and helps us carry out our security mission.”

Our vision to better manage the Department’s use of energy will continue to improve military capability across all missions. As we adapt to threats and geopolitics shaped by energy, now is the time to drive long-term innovation and energy improvements into our core business processes, force structure, and planning to ensure we have the military we need to succeed in the future.

Going forward, the Department is committed to addressing how energy shapes our capabilities and operations, as well as how it affect the missions the Department may be called upon to conduct. This past year, the Department has made great strides in reforming core business processes and decisionmaking, supporting current operations, and applying energy considerations to the development of the future force. All that said, institutional change within the Department is difficult, time consuming and not for the faint of heart; we appreciate this Committee’s continued support of OEPP.

Senator DURBIN. Thank you.
General Lewis.

STATEMENT OF BRIGADIER GENERAL KENNETH LEWIS, DEPUTY DIRECTOR OF TRANS-REGIONAL POLICY AND PARTNERSHIP STRATEGY, JOINT STAFF, J5

General LEWIS. Mr. Chairman, Senator Cochran, Senator Shelby, thank you for allowing me the opportunity to come speak today.

ARCTIC REGION

The Arctic region is changing. The emergence of new challenges and opportunities in the region are demanding greater attention from Government and stakeholders.

While significant uncertainty remains about the rate, extent, and pace of these changes, human activity in the Arctic is increasing and will likely continue.

With more activity comes a potential of increased security challenges, but also it presents new opportunities. In planning the Armed Forces’ future role in the Arctic, we see the opening of the region as an opportunity to work collaboratively with allies and partners to keep the Arctic a secure and stable region where U.S. national interests are safeguarded, the U.S. homeland is protected, and nations work together to address challenges.

The Armed Forces’ existing infrastructure and capabilities are sufficient to perform required missions in the Arctic in the near-to mid-term. This point must be emphasized, because some recent reporting, I think, has overemphasized changes in the security landscape.

For example, some media reporting highlights exponential growth in the use of Arctic shipping lanes for global commerce. The present reality, however, is that an extremely small percentage, 1 to 2 percent of the total global shipping activity, occurs in the Arctic.

As uncertain as the rate of the activity may be, we recognize that years from now, more activity is likely to lead to greater security and safety challenges. These uncertainties result in a difficult situation for DOD, where we must balance the risk of having inad-

equate capabilities and insufficient capacity with the cost of making premature and/or unnecessary investments.

The view that competition for resources and boundary disputes will lead to regional conflict overlooks the fact that the Arctic is a region bounded by Nation States that are not only publicly committed to approaching Arctic issues with a common framework of international law, but these nations have demonstrated the ability and commitment to doing so for the last 50 years.

This low-level threat in the region is reflected in our DOD strategy. Our strategic approach to the Arctic seeks to link goals with resources and activities in a manner that is consistent with a low-level threat and the uncertainties regarding the rate of increase in human activity, all the while taking practical physical realities into consideration.

We seek to preserve freedom of the seas in the Arctic. This is strategically consistent with our global interest preserving all the rights, freedoms, and uses of the sea and airspace recognized under international law. Promoting navigational and overflight freedoms, whether in an increasingly accessible Arctic or in other maritime spaces, such as South China Sea, is vital to preserving global mobility of our Armed Forces and communicates to all the world that the United States is committed to upholding international norms and the rule of law.

We continue to support the accession to the Law of the Sea Convention because it codifies the rights, freedoms, and issues, and uses the sea and airspace DOD, State, Coast Guard, and other Federal Departments and Agencies would like to preserve.

Our Armed Forces are manned, trained, and equipped to be the away team, operating forward deployed for extended periods of time in some of the most austere environments in the world. The U.S. military supports and collaborates with domestic civil authorities, allies, and international partners in search and rescue, humanitarian assistance, and disaster relief. Establishing a foundation of cooperation in these areas, both internal and external to the U.S. Government, is vital to this success.

In summation, we are optimistic in our assessment that increased human activity and accessibility in the Arctic will provide opportunities to work collaboratively, promote a balanced approach, improving human and environmental security in the region.

PREPARED STATEMENT

In such a security environment, we have currently assessed our existing defense infrastructure and capabilities in the region are adequate, like I said, to meet the near- and mid-term defense needs. But as with any region, capabilities will have to be reevaluated as conditions and regional activities change and any gaps will need to be addressed.

So I thank you for the opportunity to appear this morning and look forward to your questions.

[The statement follows:]

PREPARED STATEMENT OF BRIGADIER GENERAL KENNETH LEWIS

Mr. Chairman, Vice Chairman Cochran, distinguished members of the Defense Appropriations Subcommittee, thank you for the opportunity to appear before you this morning.

The Arctic region is changing. This year, the Navy concluded in its Arctic Roadmap that ice conditions in the Arctic Ocean are changing at a more rapid pace than first anticipated in the first Arctic Roadmap in 2009. The emergence of new challenges and opportunities in the Arctic is demanding greater attention from governments and stakeholders.

While significant uncertainty remains about the rate and extent of changes in the region and the pace at which human activity will increase, human activity in the Arctic is increasing and will likely continue to increase. With increased activity comes the potential for increased security challenges, but also new opportunities. In planning the Armed Forces' future role in the Arctic, we see the opening of the region as an opportunity to work collaboratively with allies and partners to keep the Arctic as a secure and stable region where U.S. national interests are safeguarded, the U.S. homeland is protected, and nations work cooperatively to address challenges.

The Armed Forces existing infrastructure and capabilities are sufficient to perform required missions in the Arctic in the near to mid-term. This point must be emphasized because some recent reporting has overemphasized the changes in the security landscape.

For example, some media reporting highlights exponential growth in the use of Arctic shipping lanes for global commerce. The present reality, however, is that an extremely small percentage, between 1 to 2 percent, of total global shipping activity occurs in the Arctic, and much of that activity is local fishing and destination shipping, meaning shipping from one area of the Arctic to another area of the Arctic. The small numbers of transits through the region are not necessarily preferred by the shipping industry due to added expense for icebreaking and other services and increased risk from less predictable weather. As uncertain as the rate of activity may be, decades from now more activity is likely to lead to greater security and safety challenges. These uncertainties result in a difficult situation where we must balance the risk of having inadequate capabilities or insufficient capacity with the opportunity cost of making premature and/or unnecessary investments.

Various sources indicate there are significant undiscovered mineral and hydrocarbon resources in the region, and media reporting would indicate that a "Wild-West, gold rush" mentality exists with Arctic and non-Artic nations racing to stake claims to these resources. Additionally, it is widely reported that regional boundary and territorial disputes, the resolution of which inevitably impact jurisdiction over potentially valuable resources, may be a source of tension and conflict in the region.

The view that competition for resources and boundary disputes will lead to regional conflict overlooks the fact that the Arctic is a region bounded by nation states that have not only publicly committed to approaching Arctic issues within a common framework of international law, but have demonstrated the ability and commitment to doing so over the last 50 years. This low level of threat in the region is reflected in DOD's strategy.

Our strategic approach to the Arctic seeks to link goals with resources and activities in a manner that is consistent with the low threat environment and uncertainties regarding the rate of increase in human activity while taking practical fiscal realities into consideration.

Activities to accomplish our goals run the range from national interests of global application to issues unique to the Arctic region.

For example, we seek to preserve freedom of the seas in the Arctic as a necessary component and strategically consistent with our global interest in preserving all of the rights, freedoms, and uses of the sea and airspace recognized under international law. Promoting navigational and overflight freedoms, whether in an increasingly accessible Arctic or other maritime spaces, such as the South China Sea, is vital to preserving global mobility of our Armed Forces and communicates—to liked-minded partners and allies as well as states seeking to restrict freedom of the seas—that the United States is committed to upholding international norms and the rule of law. We continue to support accession to the Law of the Sea Convention because it codifies the rights, freedoms, and uses of the sea and airspace DOD, State, Coast Guard, and other Federal departments and agencies seek to preserve.

Our Armed Forces are manned, trained, and equipped to be the "away team," operating forward deployed for extended periods of time in some of the most austere environments in the world, Alaska's vastness and harsh conditions throughout the entire Arctic region, present us with a unique opportunity to enhance human and

environmental security and safety as both a “home team” and an “away team” by supporting and collaborating with both domestic civil authorities and allies and international partners to support search and rescue or humanitarian assistance and disaster relief. Establishing a foundation of cooperation—internal and external to the U.S. Government—is vital to success for both an emergent humanitarian crisis and long term stability in the Arctic.

While the most significant changes to the Arctic itself may be years away, we are currently well-postured with existing infrastructure and capabilities as well as a strategy to support our long-term planning efforts. Though we are presently well-postured, we are not idly waiting for the all the multi-year ice to recede. We are currently focused on improving sea ice and weather forecasting, enhancing domain awareness, and evolving communications and satellite capabilities. Progress in these areas is vital as these are necessary key enablers should increased presence and operations be required in the future.

In sum, we are optimistic in our assessment that increased human activity and accessibility in the Arctic will provide opportunities to work collaboratively to promote a balanced approach to improving human and environmental security in the region. In such a security environment, we have currently assessed that existing defense infrastructure and capabilities in the region are adequate to meet near- to mid-term U.S. defense needs. As with any issue or activities, capabilities will need to be reevaluated as conditions and regional activity changes, and any gaps will need to be addressed and we will periodically reassess missions and supporting infrastructure needs in the Arctic.

Senator DURBIN. Thank you.
Secretary Chiu.

STATEMENT OF DANIEL Y. CHIU, Ph.D., DEPUTY ASSISTANT SECRETARY OF DEFENSE FOR STRATEGY AND FORCE DEVELOPMENT

Dr. CHIU. Thank you, Chairman Durbin, Senator Cochran, Senator Shelby. It is my great pleasure to have this opportunity to testify before you today on the effects of climate change on national security.

SEVERE WEATHER EVENTS

As you well know, the Department of Defense’s primary responsibility is to protect our national security interests around the world. And to do this, we need to consider all aspects of the global security environment and plan appropriately for potential contingencies and the possibility of unexpected developments both in the near and longer terms.

It is in this context that the Department of Defense must consider the effects of climate change, such as sea level rise, shifting climate zones, and more severe weather events, and how these effects could impact our national security.

Some of these effects are already being seen today on military bases, installations, and other DOD infrastructure, such as increased flooding from sea level rise and storm surge. We are also seeing the potential for decreased capacity of DOD properties to support training, as well as implications for supply chains, equipment, vehicles, and weapons systems that the Department buys.

As a result, we are already adapting much of our infrastructure, including, for example, building more wind-resistant structures, protecting water supplies, wells, and improving fire breaks.

DOD is currently conducting, as well, a baseline study to be completed in late 2014 to identify what infrastructure is vulnerable to extreme weather events and sea level rise, so we can assure that these challenges are addressed appropriately.

In the longer term, the impacts of climate change may alter, limit, or constrain the environments in which our military will be operating. For example, sea level rise may impact where and when we think about executing amphibious operations, while changing temperatures and lengthening seasons could impact the timing windows for operations overall.

The effects of climate change may also compound instability in other countries and regions by affecting things like the availability of food and water, affecting human migration, and the competition for natural resources. This could create gaps in governance, creating instability, and can also provide an avenue for extremist ideologies and conditions that could foster terrorism.

Therefore, as a Department, we are working to better understand how the impacts of climate change will affect our planning and operations in the U.S. and abroad.

CLIMATE CHANGE

We are currently working to take into consideration the impacts of climate change in our longer term planning scenarios, so we can think about how it will affect our humanitarian assistance and disaster relief activities over time, look at our efforts to plan and enhance the capacity of partner militaries so that they can plan for and respond to natural disasters. And we are also working to address implications for potentially higher demands for defense support to U.S. civil authorities, due to extreme weather events.

The effects of climate change are particularly acute in the Arctic region where diminishing sea ice will make the Arctic Ocean increasingly accessible. This is a decades-long dynamic, but we must monitor and account for it today.

This is why Secretary Hagel released the Department of Defense Arctic strategy in November 2013, which, in support of the national Arctic strategy released earlier in 2013, seeks through U.S. leadership and collaboration to preserve an Arctic region that remains free of military conflict in which nations act responsibly and cooperatively, and where economic and energy resources are developed in a safe and sustainable manner.

In order to do so, DOD will focus on ensuring security, support, and safety, and promoting defense cooperation, and will prepare for a wide range of challenges and contingencies that include consideration of Arctic contingencies.

The Department currently assesses, as you have heard from the General, that the Arctic is a relatively low military threat environment and that existing and planned DOD infrastructure and capabilities in the region are adequate to meet current U.S. defense needs in the near- and mid-term future.

We will continue to reevaluate capabilities and requirements as conditions and regional activity change, and will be prepared to address any changes or gaps that could emerge.

Given the nature of climate change, in particular the Arctic, the United States response to these challenges requires a whole-of-Government approach, as well as international collaboration, both of which are the bedrock of our efforts on these issues.

PREPARED STATEMENT

By taking a proactive approach to assessment, analysis, and adaptation, DOD can definitely manage the risks posed by the impacts of climate change and minimize the effects on the Department while continuing to protect our national security interests through strong leadership.

Thank you again for this opportunity to speak with you, and I look forward to answering your questions.

[The statement follows:]

PREPARED STATEMENT OF DR. DANIEL Y. CHIU

INTRODUCTION

The Department of Defense (DOD)'s primary responsibility is to protect our Nation's security interests around the world. This includes building security globally through assurance of allies, engagement with partners, and deterrence of adversaries; prevailing in conflicts should they arise; and supporting civil authorities and others around the world in times of emergency. To ensure DOD is adequately prepared to accomplish our missions, we need to consider all aspects of the global security environment and plan appropriately for potential contingencies and the possibility of unexpected developments in both the near- and longer-terms.

As such, the Department tracks, analyzes, and considers a range of current and future trends and changes, including political-military, economics, demographics, technology, and the environment. All of these issue areas have the potential to significantly impact U.S. national security interests in both positive and negative ways. DOD must take into account these trends to ensure we are able to create and pursue opportunities when they serve our national interests and that we are ready for a wide range of challenges now and into the future.

This is why climate change is included in the 2014 Quadrennial Defense Review. In particular, we noted that: "The impacts of climate change may increase the frequency, scale, and complexity of future missions, including defense support to civil authorities, while at the same time undermining the capacity of our domestic installations to support training activities." The effects of climate change—such as sea-level rise, shifting climate zones, and more severe weather events—will have an impact on our bases and installations at home and overseas; on the operating environment for our troops, ships, and aircraft; and on the global security environment itself as climate change affects other countries around the world.

While all projections contain a degree of uncertainty, the Department considers risk across a wide spectrum of possibilities to ensure DOD is appropriately prepared for the range of possible contingencies. In considering the effects of climate change, scientific data and studies are used to further refine projections and planning. The Department also continues to update and assess this work to ensure that changes are taken into consideration so that plans and capabilities can be adapted, when needed.

Near Term: Infrastructure, Training, and Testing

The National Climate Assessment, released by the White House earlier this month, noted that the world's climate is already rapidly changing. Certain types of weather events are already occurring more frequently and intensely, including heat waves, heavy downpours, hurricanes, floods, and droughts. Glaciers and Arctic sea ice are melting at a relatively rapid rate, sea levels are rising, and oceans are becoming warmer and more acidic. Moreover, scientists predict that some of these changes will increase in frequency, duration, and intensity over the next 100 years.

Some of these current effects of climate change are being seen on the military bases, installations, and other infrastructure that DOD manages. Our infrastructure serves as the staging platform for the Department's national defense and humanitarian missions, and the natural landscape supports military combat readiness by providing realistic combat conditions and vital resources to personnel. For example, an installation may need a forest or desert landscape for maneuvers, coastal waters for amphibious assault training, or wetlands to prevent flooding and erosion. The effects of climate change will have serious implications for the Department's ability to maintain both its infrastructure and the landscape around it, and to ensure military readiness in the future.

Our coastal installations are already experiencing increased flooding and damage from sea-level rise and increased storm surge; longer-term impacts could include in-

creased inundation and erosion. Rising temperature and extreme weather will increase building heating and cooling demand, raising installation energy requirements and operating costs. Those conditions will also increase maintenance requirements for runways and roads, as well as cause disruption to and competition for reliable energy and fresh water supplies. Thawing permafrost and melting sea ice are damaging our infrastructure in Alaska and the Arctic region. Changed disease vector distribution, particularly exposure to diseases in regions in which they are not routinely encountered, will increase the complexity and cost of on-going disease management efforts, and may have acute and long-term impacts on personnel health and safety.

The Department also needs to be able to train our forces to meet the evolving nature of the operational environment by training in the field environment to achieve and sustain proficiency in mission requirements. The Department conducts testing in the field environment in anticipation of the military's use of weapons, equipment, munitions, systems, or their components. As such, access to the land, air, and sea space that replicate the operational environment for training and testing is critical to the readiness of the Force.

The impacts of climate change may decrease the capacity of DOD properties to support current testing and training rotation types or levels. Some training and testing lands may lose their carrying capacity altogether. Rising temperatures could lead to an increased number of "black flag" (suspended outdoor training) or fire hazard days. Increased dust generation during training activities may interfere with sensitive equipment, resulting in greater repairs, or may require more extensive dust control measures to meet environmental compliance requirements. These conditions could also lead to increased health and safety risks to the Department's personnel.

Climate change also impacts may affect the supplies, equipment, vehicles, and weapons systems the Department buys, where and from whom we buy them, how they are transported and distributed, and how and where they are stockpiled and stored. Changes to the operating environment may require changes to operational parameters for current and planned weapons and equipment, resulting in increased associated maintenance requirements or requirements for new equipment.

Environmental changes may introduce supply-chain vulnerabilities, reducing the availability of or access to the materials, resources, and industrial infrastructure needed to manufacture the Department's weapon systems and supplies. They may also cause the interruption of shipment, delivery, or storage and stockpile of materials or manufactured equipment and supplies. Many major corporations have recognized the potential effects of climate change on their operations and are aggressively pursuing manufacturing/supply resiliency efforts. As appropriate, the Department will seek refinements to existing processes and develop new climate-specific plans and guidance.

Because of these current and ongoing concerns, the Department initiated in 2013 a review of existing directives, policies, manuals, and associated guidance documents and criteria to identify which ones should incorporate considerations of a changing climate. The initial screen reviewed 58 documents and identified 28 policies, programs and procedures for update; five have already been updated, all dealing with installations. During 2014, the Department will work within the existing review and update cycle to establish a plan for incorporating appropriate consideration of climate change into the relevant documents.

Many infrastructure managers are already adapting to changing climate factors. Reported rebuilding efforts after extreme storms include upgrading to more wind-resistant structures, burying utility lines underground, changing storage locations for chemicals used in low-lying wastewater treatment plants, protecting water supply wells, and removing vulnerable trees. In preparation for the possibility of more wildfires, installations reported preparing better firebreaks and making timber stand improvements to reduce fire fuel loads.

The Department has updated our master planning criteria for installations to require the consideration of climatic conditions, as well as mandating the consideration of changing climate conditions when designing buildings, including potential increased heating or cooling requirements. We also issued a Floodplain Management Policy in February 2014 that establishes requirements to minimize risks when military assets must be located within flood plains.

The Department is exploring the expansion of applications of risk management schemes already in use, primarily within the Defense Critical Infrastructure Program. Decisions on where and how to locate future infrastructure will become increasingly reliant on robust risk management processes that account for dynamic factors associated with the effects of climate change. While the initial modifications

to risk management methodologies are focused on critical infrastructure, it is anticipated that the Department will utilize them across all decisionmaking in the future.

The Department has initiated several research and survey efforts to more fully identify and characterize vulnerabilities, impacts, and risks posed by climate change. The Department is implementing a phased installation-level vulnerability assessment approach to: develop methodologies for conducting consistent screening-level vulnerability assessments of military installations world-wide (starting with coastal and tidal installations); leverage recent scientific advancements regarding coastal assessment; and provide a platform to build upon prior to conducting more comprehensive and detailed assessments, whether coastal installations or otherwise.

A screening level survey assessment tool was piloted in the Fall of 2013 and was deployed in 2014 to assess current installation-specific vulnerability to the impacts of climate-related events. Data from these screening-level assessments will be used to identify areas and installations where more detailed vulnerability assessments may be needed. The Department is using a whole-of government approach to develop recommendations on regional sea-level rise for use in more detailed coastal vulnerability and impact assessments of military installations worldwide, to ensure consistency in conducting these assessments.

As climate science advances, the Department will regularly reevaluate climate change risks and opportunities in order to develop policies and plans to manage its effects on the Department's operating environment, missions, and facilities. Research organizations within the Department, including the Strategic Environmental Research and Development Program (SERDP), are planning and completing studies to characterize climate change impacts in specific regions of the world and develop and pilot vulnerability assessment and adaptation methodologies and strategies.

Research to develop coastal assessment methods is scheduled for completion during 2014. Work in other regions is still underway, including research designed to understand how increased temperature trends and changes in the fire regime in the interior of Alaska will impact the dynamics of thawing permafrost and the subsequent effects on hydrology, access to training lands, and infrastructure; and how changes in storm patterns and sea levels will impact the Department's Pacific Island installations, including their water supplies.

The Department is actively conducting research that will support further integration of climate change into our considerations. This includes projects that: assess potential changes in the intensity, duration, and frequency of extreme precipitation events, including changes in the timing and intensity of snowmelt and subsequent run-off events; include development of adaptive decision frameworks; and address understanding the characteristics of species that are either conservation reliant or adaptable to potential changes in climate and human activities.

Longer-Term: Plans and Operations

The longer-term impacts of climate change may alter, limit, or constrain the environments in which our military will be operating. For example, sea level rise may impact the execution of amphibious landings; changing temperatures and lengthened seasons could impact timing windows for operations; and increased frequency of extreme weather could impact assumptions about flight conditions that could affect intelligence, surveillance, and reconnaissance capabilities.

The impacts of climate change may aggravate existing or trigger new risks to U.S. interests. Maintaining stability within and among other nations is an important means of avoiding full-scale military conflicts. The impacts of climate change may cause instability in other countries by impairing access to food and water, damaging infrastructure, spreading disease, uprooting and displacing large numbers of people, compelling mass migration, increasing competition for natural resources, interrupting commercial activity, or restricting electricity availability.

As Secretary of Defense Chuck Hagel said at the 2013 Halifax International Security Forum, "Climate change does not directly cause conflict, but it can significantly add to the challenges of global instability, hunger, poverty, and conflict. Food and water shortages, pandemic disease, disputes over refugees and resources, more severe natural disasters—all place additional burdens on economies, societies, and institutions around the world."

These developments could undermine already-fragile governments that are unable to respond effectively or challenge currently-stable governments, as well as increasing competition and tension between countries vying for limited resources. These gaps in governance can create an avenue for extremist ideologies and the conditions that foster terrorism.

As a Department, we are working to better understand how the impacts of climate change will affect plans and operations in the United States and abroad. The Department's unique capability to provide logistical, material, and security assistance

on a massive scale or in rapid fashion may be called upon with increasing frequency. We are looking to identify early warning indicators for those areas critical to DOD's mission set, as well as conduct systematic regional and localized impact assessments to identify trends and where our resources should be focused.

The Department will be monitoring these developments and deciding which situations will require intervention based on U.S. security interests—either preemptively through security cooperation and capacity building, or through stability operations if conditions escalate. We are exploring ways for the combatant commands to include in their missions non-combat support to address serious climate change-related U.S. national security vulnerabilities and to include climate considerations in their theater campaign plans.

We are currently working to integrate the impacts of climate change into our longer-term planning scenarios, which articulate a range of future challenges that U.S. military forces must be prepared to confront. These scenarios support deliberations by DOD senior leadership on strategy and planning, programming, budgeting, and execution (PPBE) matters, including force sizing, shaping, and capability development.

We also plan to more fully integrate the impacts of climate change into our humanitarian assistance/disaster relief and other exercise plans, and are working to enhance the capacity of partner militaries and civil response readiness groups to plan for, and respond to, natural disasters. As noted in the 2014 QDR, "Climate change also creates both a need and an opportunity for nations to work together, which the Department will seize through a range of initiatives."

We also hope to more systematically harness resources beyond the traditional combatant command structure. This included the National Guard, and its State Partnership Program, service engineering units such as the U.S. Army Corps of Engineers and Naval Facilities Command, and OSD-led programs such as the Defense Environmental International Cooperation Program and the Strategic Environmental Research and Development Program.

To the extent that we are engaged in the construction of military and civilian infrastructure for partner nations, we are working to include consideration of climate change impacts on all our projects, ranging from site selection to resiliency planning.

Here in the United States, State and local governments responding to the effects of extreme weather may seek increased defense support to civil authorities. The heightened demand, particularly on the National Guard and Reserve Component, could impact their availability for other contingencies or operations. We are in the process of exploring these implications and finding the right balance to ensure that our domestic needs can be met.

The Arctic

The effects of climate change are particularly acute in the Arctic region. Profound changes are already occurring that are having and will continue to have significant and long-lasting consequences. Over the coming decades, the Arctic will remain a remote, isolated, and complex environment; but over time, diminishing sea ice will make the Arctic Ocean increasingly accessible and used by Arctic as well as non-Arctic nations. At the same time, land access—which depends on frozen ground in much of the Arctic—will diminish as permafrost thaws.

Although some recent media reporting overstates the nature of current human activity and potential for military conflict in the near term, the U.S. Government, including DOD, must account for and closely monitor the long-term dynamics in the Arctic. Regardless of the rate and scale of change, we must be ready to contribute to national efforts in pursuit of strategic objectives in the region.

In response to these changing dynamics, the Department released a DOD Arctic Strategy in November 2013. The DOD Strategy supports the overarching national approach to the Arctic, embodied in the National Strategy for the Arctic region (released in May 2013): advancing U.S. security interests, pursuing responsible Arctic region stewardship, and strengthening international cooperation.

In accordance with the National strategy, the DOD Strategy seeks to preserve an Arctic region that is free of conflict, in which nations act responsibly and cooperatively, and where economic and energy resources are developed in a sustainable manner. In order to do so, we will ensure security, support safety, promote defense cooperation, and prepare for a wide range of challenges and contingencies.

The DOD Strategy recognizes that the U.S. Government response to changes in the Arctic requires a whole-of-government approach. In terms of preserving security, the U.S. Coast Guard in particular faces distinct near-term challenges. DOD continues to seek opportunities to coordinate our responses with the Coast Guard to

leverage existing resources and avoid duplication of effort. We also continue to prepare ourselves to provide defense support for civil authorities when directed.

Our Arctic strategy will enable us to take a balanced approach to improving human and environmental security. Our challenge is to balance the risk of having inadequate capabilities or insufficient capacity appropriate for this changing region with the opportunity cost of making premature and/or unnecessary investments. We assess that the Arctic is a relatively low threat environment, and that existing DOD infrastructure and capabilities in the region are adequate to meet current U.S. defense needs in the near and mid-term future.

Capabilities and requirements will need to be re-evaluated as conditions and regional activity change, and any gaps will need to be addressed. Given the low potential for armed conflict in the region, a buildup beyond what is required for existing DOD missions could send the wrong signal about our intentions for the region. We will continue to train and operate routinely in the region as we monitor the changing environment, revisit threat assessments, and take appropriate action as conditions change.

Given the nature of the Arctic, our approach to the region requires more than just interagency cooperation, it requires international cooperation. As we highlight in the 2014 QDR, relationships with allies and partners are important enablers for meeting our security and defense commitments. Our strategic approach to the Arctic reflects the relatively low level of military threat in a region bounded by nations that have not only publically committed to working within a common framework of international law and diplomatic engagement, but have also demonstrated the ability and commitment to do so.

We engage in frequent consultations with our Arctic partners, including through the Arctic Council, Northern Chiefs of Defense conference, the Arctic Security Forces Roundtable, and in Service-to-Service dialogues and exercises. Russia, one of five coastal Arctic states, has historically played a collaborative role in these forums. Although our near-term cooperation with Russia has been impacted by Russia's ongoing intervention in Ukraine, we continue to work with other Arctic partners and remain committed to the long-term objectives, approaches, and capabilities outlined in the Arctic Strategy.

INTERAGENCY COLLABORATION ON CLIMATE CHANGE

Partnerships are needed to fully ensure the Department's mission is sustainable given the effects of climate change. The Department cannot effectively assess its vulnerabilities and implement adaptive responses at its installations if neighbors and stakeholders are not part of the process. The Department's decisions and those of neighboring communities are intrinsically interconnected. Aspects of our mission, such as Force deployment, may be affected by assets outside our control, such as transportation infrastructure.

Understanding the complexities and uncertainties of climate change require a whole-of-government approach as well. Therefore, the Department already participates in nationwide efforts such as the U.S. Global Change Research Program, including the National Climate Assessment. It also partners with individual agencies such as the National Oceanic and Atmospheric Administration on, for example, the development and operational implementation of a national Earth System Prediction Capability.

The Department is also represented on interagency climate change councils and working groups and will continue to participate in Federal climate partnerships and other interagency processes. The Department, through the Air Force Weather Agency, contributes earth-space environmental data, receiving nearly 500,000 weather observations and satellite-derived wind profiles each day and sharing these data with the National Climatic Data Center and the Navy's Fleet Numerical Meteorological and Oceanographic Center.

Climate change is an inherently global problem, and will require us to work closely with our allies, partners, and other countries across the world. As such, the State Department is leading our efforts to engage with the international community on these issues in multilateral forums and in bilateral relations. DOD is collaborating with and supporting the State Department in many of these initiatives, and we are continuing to develop new mechanisms and avenues for cooperation.

CONCLUSION

The effects of the changing climate affect the full range of Department activities, including plans, operations, training, infrastructure, acquisition, and longer-term investments. The direction, degree, and rates of the physical changes will differ by region, as will the effects to the Department's mission and operations. By taking a

proactive, flexible approach to assessment, analysis, and adaptation, the Department can keep pace with the impacts of changing climate patterns, minimize effects on the Department, and continue to protect our national security interests.

Senator DURBIN. Thank you very much.

I would like to address the first question to Secretaries McGinn and Morehouse.

As I have observed over time in Congress and in this position, our procurement process is slow, deliberate, to make certain that we don't make any rash decision, which results in a waste of funds, or an investment that truly doesn't serve our Nation.

Unfortunately, the free market system—I shouldn't say "unfortunately," but in contrast, the free market system is dynamic. Things change dramatically and quickly. And the marketplace decides what are good ideas and bad ideas.

It wasn't that long ago that we would go to the Senate floor and debate at length whether we could ever reach the point where we increased the miles per gallon of the vehicles we drive. Now take a look around you. We have luxury cars being sold as hybrids. We have increased fuel efficiency in the commercial and free market space.

My question to you is: The translation between these energy efficiency improvements in the free-market private sector and whether or not we are open to receiving and capitalizing on this new technology and these new inventions when it comes to the area of energy efficiency.

Secretary McGinn.

ENERGY EFFICIENCY INITIATIVES

Mr. MCGINN. Yes, Mr. Chairman. As I mentioned, last week I was out at Camp Pendleton, fortunately, before the wildfires that were pretty serious out there, for the Marine Corps Expeditionary Forward Operating Base, in which we bring these good ideas from very innovative companies and some older, established companies to Marines with energy technologies that are new that can help to harvest energy from a Marine patrol, that can use the sun to recharge batteries, that can capture the waste heat that is coming off a generator powering a forward operating base.

So we try to be as proactive as we possibly can to, first of all, be aware of the energy innovations that are out there, that are coming, whether it is for energy efficiency or for alternative forms of energy, and then to create opportunities for those companies to actually do business with the Department of the Navy, and indeed, the Department of Defense.

We do, as you pointed out, have a very slow and complex process, a conservative culture, if you will, for procurement. But where it makes sense in smaller quantities initially, but then expanding rapidly where this technology is proven, we are in fact trying to seize these technologies.

I would conclude by saying that we also have what I would call a two-way street, in terms of energy technology and, indeed, technology across-the-board. I call it "spin in" and "spin out." We look for commercial off-the-shelf opportunities because we can get them faster. We don't have to spend a lot of time and development dol-

lars getting them to where they are useful to our warfighting capabilities.

But we also, inside the Department, do a lot of great work to develop initially unique military technologies. GPS is often used as an example, or the Internet, and, indeed, I would add to that list nuclear power.

But we also want to make sure that we are harvesting the good ideas that are out there.

Senator DURBIN. So I don't want to read too much into what you just said, or beyond what you wanted to say, but it sounds to me that at certain levels, you can translate successful private sector commercial development into applications in the military. But I also note that you may have inferred that when you get to a higher level, this becomes more difficult, because of the procurement process. Is that accurate?

Mr. MCGINN. It is. We can initially grab good technology at smaller dollar levels in smaller quantities. But to get it into a program of record, it takes longer.

Senator DURBIN. That troubles me. It was 10-plus years ago that the U.S. Army decided they needed a new communication standard on the battlefield, and that they had to really try to come up with specs for this new standard, whatever this needed to be. Ten years ago, they couldn't have dreamed of this, and we carry it around our pockets.

It strikes me that as they are trying to plod their way into some new level of technology, the world has just passed them by.

We need to talk about how we can avoid this. This is a waste of effort and a waste of taxpayer dollars to be stuck in a procurement system that is not flexible enough to seize on new technologies and new ideas.

Secretary Morehouse, any ideas?

Mr. MOREHOUSE. Yes, Senator. Just to agree with what Secretary McGinn said, but perhaps provide a slightly different twist on this, I would say that the collaboration on technology between the Defense Department and the private sector is very broad and very robust, whether we are talking about the relatively small-scale systems such as what Secretary McGinn talked about, the system that soldiers carry out into the field with them—generators, battery chargers, shelters for forward operating bases—relatively small-scale programs.

We can adopt those technologies very quickly, and we can turn those programs over very quickly. So if you look at the pace of change in the integration of technology of programs at that level, it is really quite quick. When you start looking at much larger programs such as warships, Joint Strike Fighters, those sorts of things, they take much longer to develop.

The technological collaboration is there, but these programs take much longer to go from concept to actual acquisition and become programs of record.

So I wouldn't say that the collaboration is necessarily not there, but the requirements of development process and the acquisition process—the larger and the more complex the systems become, the longer those processes take.

Senator DURBIN. Someone in the Pentagon once told me that if Congress and the American people knew what it cost to move a gallon of fuel into Afghanistan, they would understand why this conversation is about taxpayer dollars, national security, and literally life and death. Anybody have any numbers they can quote us?

EXPEDITIONARY FUEL NEEDS/COSTS

Mr. MCGINN. We have had numbers in the past, in the height of the Afghanistan war, that if you go to a very remote forward operating base, Army or Marine forward operating base, and you multiply all of the costs of getting a gallon of fuel to that, it costs as high as \$400 a gallon of crude. That is from where we buy it originally, the cost of transporting it in a truck, or in some cases in a helicopter, and all of the costs associated with protecting those logistic lines.

That is why when we do something like the forward operating base the Marine Corps is doing, we try to cut down—the reduction of a gallon of gasoline, or diesel, I should say, to power a generator at a foreign operating base has wonderfully compounding effects up the supply chain. It saves a lot more than just that one gallon of diesel.

And as you point out, we pay a price in treasure as well as in blood, because those missions of protecting fuel convoys are some of the deadliest in Iraq and Afghanistan.

Senator DURBIN. The first Illinois National Guard unit that I visited in Kuwait on their way into Iraq, they were driving fuel tanker trucks. And although to the civilian side of the world, it may seem like a mundane assignment, it was literally a life-and-death assignment, not only for transporting the fuel but the people waiting to receive it so that they could be protected with the fuel and equipment that it energized.

Senator Cochran.

Senator COCHRAN. Mr. Chairman, I am pleased to join you in welcoming the distinguished panel of witnesses to our hearing today.

Are there any changes that you are aware of that the military has actually promoted or implemented that have had specific savings in terms of environmental consequences? You mentioned Iraq and the situation there. But in our training here stateside, where we probably have a better opportunity to monitor and measure and make decisions about things like this, are there any new things that have been implemented, new procedures implemented, that you can point to that reflect a greater awareness of any environmental consequences of training and operations here within the continental United States?

ENVIRONMENTAL IMPACTS OF TRAINING AND OPERATIONS

Mr. MCGINN. One of the big advances that has happened—it has been happening for a number of years—is our increasing use of simulation. You can have a carrier battle group or amphibious readiness group literally tied to the pier and not have to go to sea to do the kind of sophisticated command-and-control training that traditionally we have always had to go to sea to do.

What this means is that when that amphibious readiness group or carrier battle group goes to sea, they are operating at a much higher level. They know how to communicate. They know how to coordinate their efforts.

The same thing is true for our aviators where we are not trying to substitute flying time with simulators, but we get so much more warfighting readiness and training capability when they do fly because they have been working through the process in the simulators.

Senator DURBIN. Senator Shelby.

Senator SHELBY. Thank you.

You realize, as we all do, that we have discovered a lot of gas in this country, thank God, and a lot of oil, and a lot more potential. We could be soon an exporter of gas, if not an exporter of oil. We are not quite there.

But it is not how much you have. It is how much you use and how efficiently you use things.

What are you doing, specifically, as far as efficiency is concerned, because we could give you an open-ended account, which we can't—we could have at one time, maybe. But the cost of energy for the Department of Defense is tremendous. I haven't got that exact dollars, but I can get it from the staff.

But how can we be more efficient? We know that \$400 a gallon end-user in Afghanistan, that doesn't reflect the initial cost. It reflects getting it to a remote area and transportation and everything.

And we will always have those kinds of challenges, because when we project force, it is generally not in an urban area. It is generally not where we have railroads and ports and four-lane highways or six-lane highways waiting for us, and pipelines waiting for us.

So what are you doing as far as real efficiency, and what has Defense done to mark that, like the last 4 years, in this administration, Mr. Secretary?

ENERGY EFFICIENCY INITIATIVES

Mr. MCGINN. Senator, we are attacking efficiency vigorously in two ways. One with the insertion of new technologies that are inherently more efficient. Putting stern flaps on the back of our ships, is one example. I mentioned the two ships, *America* and *Makin Island*.

But the other equally powerful dynamic for getting efficiency is culture, just really letting our sailors and marines understand that energy is a warfighting necessity and that we can get more fight for less fuel, if we are wise in how we use the equipment that we actually have today.

As you point out, we have a blessing now in fossil fuel extraction that is going to help this country with our balance of payments, our economy, literally, our national security, for many years. But we want to make sure that as we are succeeding in doing that, that we use the time and these blessings of these resources wisely, so that when we come up 5, 10, 15, 20 years out in the future, we don't find ourselves looking back saying, "Gee, I wish we would have done more with energy efficiency technology or greater energy awareness, and our soldiers, sailors, airmen and marines," but

rather we are going to be using every gallon of liquid fuel, every kilowatt hour of electricity, to squeeze the absolute maximum warfighting readiness and quality of life out of those units of energy.

Senator SHELBY. How can you recommend, and how can we help, to reform the procurement process that Senator Durbin talked about—it seems like it is antiquated—and put in some principles that are used every day by business and the marketplace.

We have end-users of energy, they may not buy quite as much, but they buy a lot of energy. And their procurement processes are flexible. They have to react to the dynamic marketplace, as Senator Durbin alluded to.

Mr. MCGINN. I would say that the way to seize emerging technologies that sure makes sense for any aspect of our Department's mission is to create a fund that would be similar to a venture fund, not as perhaps early stage technology.

But as you well know, especially on this committee, just about every dollar is spoken for in the budget. And creating some funds that can be used to get the procurement of that technology that saves energy or produces better warfighting capability would be one way to go.

ARCTIC

Senator SHELBY. Well, without energy, we are not going to project force. We are not going to run helicopters. We are not going to run fighter-bombers. We are not going to run submarines. We are not going to run ships. That is a given, fundamentally.

It was brought up, the seas will begin to rise. A lot of people project that, and so forth. And we talk about the Arctic. Of course, we have a Senator here from Alaska who knows a lot more about that than most of us do, and the impact there.

There are minuses and pluses everywhere. Norfolk, that was referenced, that big naval base, very important there.

But as it thaws up in the Arctic, in the Bering Sea and everything, that is going to open up possibilities of huge hydrocarbons that we haven't tapped before, would it not, for better or worse?

Dr. Chiu.

Dr. CHIU. Senator, that is correct. There are significant opportunities as the Arctic warms and changes. Obviously, we have to balance that against the challenges as well. But I think that you are correct, there are both opportunities and challenges there.

Senator SHELBY. But Russia is very cognizant of all that, are they not?

Dr. CHIU. Yes, sir.

Senator SHELBY. They realize that there are going to be huge hydrocarbon opportunities, or at least they believe there are in the area.

And we shouldn't fall behind in that area, should we, Doctor?

Dr. CHIU. That is correct. So we are absolutely monitoring that situation, particularly with Russia. Russia has paid a lot of attention, is investing a lot of money in its Arctic structure.

Senator SHELBY. Well, we shouldn't just monitor it. We should be proactive in the area, should we not?

Dr. CHIU. Agreed, sir. So we are seeking to do that by, in particular, ensuring, as the General has mentioned before, that the basic laws and norms with regard to freedom of the seas and of territoriality are being well-respected in those regions.

The one thing that I would just emphasize on this particular point is, as we talk about being proactive and not falling behind in any way, which I agree is absolutely where we need to be, is we do need to balance that against the timeframe of the changes that we are seeing in the Arctic.

This really is, even with as concerned as we are about ice melt and sea level rise at this time, this really is a decades' long process that we are seeing. And so should we be absolutely acutely paying attention to this because, by the way, these capabilities and structure require a long lead time—

Senator SHELBY. We have to be cognizant of the danger, but also of some opportunities it could possibly bring to offset. Am I right?

Dr. CHIU. Yes, sir. I think that is exactly right. And balancing that in terms of finding the right time to make those investments appropriate to the changes—

Senator SHELBY. Do you have any judgment today as to the oil and gas potential of the Arctic area?

Dr. CHIU. I don't have that figure with me, but I know that there are estimates.

Senator SHELBY. It would be tremendous. More than we ever dreamed, perhaps?

Dr. CHIU. It could be. I don't know, sir.

Senator SHELBY. Thank you, Mr. Chairman.

Senator DURBIN. Senator Murkowski.

Senator MURKOWSKI. Thank you, Mr. Chairman. I have to admit that my heart has skipped a beat in pure delight that a Senator from the South, Alabama, has been talking about the Arctic. I feel like sometimes I am a one-trick pony. I am the only one talking about Arctic.

Senator SHELBY. What they produce up there affects us all.

Senator MURKOWSKI. Sure it does.

OIL AND GAS IN THE ARCTIC

Senator SHELBY. It is oil and gas. That is a commodity.

And that is why I have supported what you have tried to do up there for years.

Senator MURKOWSKI. And I appreciate the questions that are asked, because they are very, very pertinent to the discussion this morning when we talk about energy and our energy security from a defense perspective.

Senator Shelby, you asked about the amount. It is estimated that about 20 to 22 percent of the world reserves of oil and gas could be in the Arctic. Of course, that doesn't necessarily mean they are recoverable. But the understanding in terms of the resources that are there is huge.

Senator SHELBY. What was not recoverable 30 to 40 years ago is being recovered today. Technology changes.

Senator MURKOWSKI. Technology has changed in a dramatic way.

Senator SHELBY. Absolutely.

Senator MURKOWSKI. But it does present opportunities. It clearly presents challenges.

I would recommend to all of you, if you have not seen it, the GAO report that came out this week. I had requested it, along with colleagues on the House side, to look exactly at where we are in terms of preparedness when it comes to the Arctic and our opportunities as a Nation to take over the Arctic Council next year.

The report came back and said what I think most of us have known, that we are behind. We are behind just in our own preparedness. Not necessarily from a defense perspective, but just in terms of what we are doing as a country.

I would agree with you, Dr. Chiu, there is a lag there. But I also know how long it takes to build an icebreaker. I also know how long it takes to move initiatives through the appropriations process, get them all the way up the chain and get something moving. So I continue to press on the urgency.

We recognize that we have limited infrastructure in the Arctic, limited support facilities. That is a given. It requires significant energy just to get to where you need to get at the top of the world there.

We also look at what the administration's pivot to the Pacific means in terms of just expanded areas. You have to assume, then, that we are talking about increased energy needs.

MULTI-ENVIRONMENT ENERGY INITIATIVES

Mr. McGinn, these are two very different operating environments, the Pacific region and then the Arctic. When you look for ways to be energy efficient and reduce energy uses, how much do you focus on this multi-environment capability?

Mr. McGinn: We now know, Senator, that there are demands that are driven by operating in different environments, and we understand clearly that we have to be ready to operate in all of them.

We adjust our investments, if you will, over time, depending on where we see the most compelling need at, let's say, a timeline of about the next 5 years or something like that.

But having, during the dark days of the Cold War, operated up in the very, very northern reaches of the Pacific, I personally can understand that it is a very demanding environment. It is one that we have proven the ability to operate. We still send ships up there. We operate in a joint context with our Air Force and Army counterparts based in Alaska and across that northern Rim of the Pacific.

Senator MURKOWSKI. As you acknowledge, it is challenging, but it is, certainly, doable. We have been doing it for a long, long time, and I think exceptionally so.

Mr. Morehouse, I wanted to ask you about a study that your office was charged with overseeing. This came out of last year's defense authorization bill. DOD was directed to carry out a study to assess the feasibility of small modular reactors (SMRs) of less than 10 MW.

SMALL MODULAR REACTORS

I happen to think that these SMRs are a good thing. I think they can assist in some of our more remote areas. Eielson Air Force Base is a perfect example of an installation that is just geographi-

cally strategic, unlike most around the world, not only with its location sitting up there in the interior of Alaska, poised to be able to respond in a way that most can't, but you have unparalleled training grounds in the air and on ground. But they suffer from the daily reality of very high energy costs in an area where you have to be able to keep warm.

It has been suggested, following a study, not only the one that you were charged with overseeing, but other studies, that the next step with these SMRs is to explore site-specific contracting operations between DOD and the utilities. I raised this issue about SMRs and the applicability of some of our military installations with Mr. Shaffer, who is with the Defense Research and Innovation offices. We had him before the committee last week.

He indicated it is still expensive. We understand that. But I guess my question to you this morning is: What are your thoughts on the potential and really a recommended way ahead when we are talking about small modular reactors?

Mr. MOREHOUSE. Thank you, Senator. Conceptually, they seem like an idea with a lot of promise.

What we have done in response to the specific NDAA language, asking us to go do a study, the language was directed toward foreign operating locations, so we needed to pull together people who understood SMR technologies but also understood forward operating locations, what it is like to operate in those areas. So we chose the Defense Science Board as the mechanism for doing that. We identified our cochairs. We are in the process now of putting together the membership.

That study will get kicked off fairly soon. We expect to have some results next year, but it will be the integration of knowledge on both sides of that issue. We will let the chips fall where they may.

Senator MURKOWSKI. Very quickly here, Mr. Chairman. We, again, appreciate the difficulties of operating some of our installations in very cold places, Eielson, Fort Greeley, Clear. It is a major consideration, as you well know.

And as you are assessing, not only the opportunities for something like small modular reactors and their potential there, is there anything that DOD can do to provide a more comprehensive assessment of energy at some of our more remote locations like Greely, like Eielson, that not only would detail the costs that are at play, but perhaps outline some of the feasible options or alternatives?

I know that within Alaska, the Alaskan command has been looking specifically to this type of an assessment. But from a broader DOD perspective, is that something that is being conducted or considered?

Mr. MOREHOUSE. We are in the process of looking at energy resilience as an important part of our military operations. We are looking at where are the critical nodes in critical missions, how resilient are those nodes. Energy is a key component of that mission assurance assessment.

With respect to the SMR study, we have asked the team to look at it also in terms of use cases. Are there use cases out there that would seem appropriate for the characteristics of an SMR.

So we are asking the question both ways, so we think that the study will actually reveal some of those opportunities.

In terms of interaction with the private sector, as you know, we buy energy as a utility. We buy it on the commodity markets. So our interactions with utility companies and so forth are very important.

There are perhaps some opportunities to work with utilities through power purchasing agreement (PPA) options that may help move this along. Currently, we don't have the authority to enter into PPAs for nuclear power as we do with renewable energy, so that potentially is an avenue worth exploring as well.

Senator MURKOWSKI. And when do you figure that study will be complete?

Mr. MOREHOUSE. I don't have the timeline yet, but we expect it to be out sometime next year.

Senator MURKOWSKI. I look forward to discussing that with you.

Mr. MOREHOUSE. Okay, thank you.

Senator MURKOWSKI. Thank you, Mr. Chairman.

CLIMATE CHANGE

Senator DURBIN. Thank you, Senator.

It is interesting to compare the debate on climate change on Capitol Hill and in the Pentagon, because on Capitol Hill, there are various schools of thought. Some believe it exists. Some who are elected officials deny it completely. Some believe that it exists, but question its source. And others say, regardless of source, there are certain things that we should do about it.

Most, I think, acknowledge something is going on out there with extreme weather and some of the indicators we have of changes around the world.

Now when we go over to your world in the Pentagon, I don't find much debate. In fact, it is pretty clear that, from a military and defense posture, we view this as a real challenge. You may not have the recipe for averting this challenge, but a real challenge that has to be faced squarely.

I had a chance to visit my colleagues in Hawaii a few weeks ago and met with Admiral Locklear, the Pacific Commander, and I was impressed with his operation.

He has been unequivocal. He has testified, not 1 year but 2 in succession, that climate change is the number one long-term threat in the Asia-Pacific. He identifies two things, natural disasters, which occur at a much higher pace and greater rate in that region of the world, which will require some military awareness, if not response; and secondly, the impact of sea rise and other environmental changes on the populations of this part of the world, creating migrations, political instability, perhaps even a breeding ground for terrorism.

All of these things are part of his calculation about America's defense posture when it comes to the Asia-Pacific. We have strategists here as well as the practitioners dealing with these energy issues. I would like to ask you, as you assess our challenges to come in the decades ahead, as we look beyond the horizon, how big of a factor is this?

Admiral Locklear says it is the number one threat in the Asia-Pacific. Globally, how big a threat is climate change to the security of the United States? I can't think of a more open-ended question.

FUTURE ENERGY CHALLENGES AND POTENTIAL RESPONSES

Mr. MCGINN. Senator, it is an absolutely right question. As to the differences between how climate change is dealt with in the Pentagon versus on Capitol Hill, I think the original chairman of the CNA military advisory board, Gordon Sullivan, former Chief of Staff of the Army, said it best. He said we never have 100 percent certainty. If you wait for 100 percent certainty on the battlefield, something bad is going to happen.

We look for indicators, warnings, reasons to take actions that are prudent, not to completely place a bet on one particular certainty happening. But it is clear, overwhelmingly clear, to everybody in the Pentagon and to a majority of folks, I believe, in our Nation, that climate change is happening and that we need to do something about it.

And those two categories of actions, I would say, would be we need to try to mitigate the worst effects of it by reducing the amount of greenhouse gas we are pumping into the atmosphere. But importantly, we know that severe weather is going to be with us for many, many decades to come. We need to be able to adapt to it.

In the case of the Navy, we need to make sure that if we have installations that exist in a FEMA floodplain, for example, that we are building places that are going to be safe, not when the sun is shining and the sky is blue, but when the wind is howling and that sea level rise that is caused by surge similar to what we saw a couple years ago, a year and half ago, up in New York and New Jersey with Superstorm Sandy.

We are dealing with this as a serious threat because it is. And as Dr. Chiu pointed out, when you have fragile societies and fragile governments around the world, as we do in many areas of national security importance to the United States, and you add to those fragile societies increased pressure from adverse weather that is more intense, more frequent than we have seen in the past, they fail. And that is a recipe for instability and could escalate all the way from humanitarian assistance, disaster relief for the United States forces, all the way up to regional war, if there is cross-border migration or other competition for scarce resources.

Senator DURBIN. Any others wish to comment?

Dr. CHIU. I will just strongly agree with that and reinforce what Admiral Locklear has said. He definitely is correct in stating his strong concern with the effects of climate change on his AOR. As you have correctly pointed out, he has a number of different manifestations of it to deal with.

But as Secretary McGinn mentioned, and in answer to your specific question, it is, certainly, one of many considerations that we need to look at when we look at national security interests in that region.

This is why we have used the term, and I think you have heard us use it both in the QDR and others have used it in other venues, that climate change to us is a threat multiplier. It really can exac-

erbate many of these existing or emerging tensions. And this is why we do need to pay particular attention to it.

Senator DURBIN. I would just close by saying I believe what you are saying is right on and that we are fools not to acknowledge it. I have tried to have hearings on the subject. I do not invite in environmentalists, as much as I respect them, because there are many who are skeptical of them. I invited in the commercial property insurance industry, which said flat out, we don't insure these things anymore because we can't create a reserve for the exposure because of extreme weather conditions and climate change.

And I have invited in the defense spokespeople today, because you are looking at it from a real-world perspective that has less concern about who is running in the next election and more concern about the threats we face in the future.

Senator Cochran.

Senator COCHRAN. Mr. Chairman, I have no further questions.

Senator DURBIN. Thank you.

Senator Shelby.

Senator SHELBY. I have several questions. I will try to be brief.

Going back to the procurement process, we know we face long-term energy challenges. In the short term, we know there is something going on worldwide. It is not going to just affect us. It is going to affect everybody. And we have to be cognizant of that and plan for it as much as we can.

But in the procurement process, General Lewis, when the Air Force, for example, now—maybe they didn't have to in the past but will in the future, I think, because of scarce dollars—you are looking for a plane, for example, either a transport plane, a fighter bomber, whatever, for a mission, and it is long-term procurement.

You want a weapon system, for the lethality of it, that can outmaneuver everything as far as physics is concerned, and everything, all of our potential enemies in the world. But how much goes into the procurement? And how can you construct, devise, design an engine for a plane, transport and otherwise, to save energy and for efficiency? Does that go into the procurement process or is that way down the line?

Because in the marketplace, which Senator Durbin alluded to, our air carriers, they transport mainly people and goods. Efficiency of those engines are of the utmost because of the cost of energy.

You want to respond to that? Do you know? If the thought of energy expense goes into the procurement process of an engine, and if so, where is it in the priority list?

General LEWIS. Senator, I am not in the procurement business.

Senator SHELBY. Okay. I will direct it to the Secretary.

Secretary Morehouse.

ENERGY KEY PERFORMANCE PARAMETERS

Mr. MOREHOUSE. Thank you, Senator. One of the initiatives our office started when we were stood up was something called an energy KPP (key performance parameter). A KPP is a key performance parameter for new weapon systems. It is one of the definitions of what does this thing have to do, what does this performance have to be.

And the idea behind the energy KPP was that how much energy will this thing demand when it is doing what is supposed to do.

Senator SHELBY. To do its mission. Sure.

Mr. MOREHOUSE. Correct.

So we have developed the analytic basis, if you will, for understanding how to establish that energy KPP. That becomes a requirement, if you will, a fundamental requirement for the system when it comes out the other end of the acquisition process.

Senator SHELBY. Is this new? Is this relatively new in the procurement process, the last 7, 8, 10 years?

Mr. MOREHOUSE. It is very new in the process, within the past 2 or 3 years.

Senator SHELBY. Okay.

Mr. MOREHOUSE. Yes, sir.

We are just getting the hang of how to do this. We have number of programs that are coming through now that have the energy KPP assigned.

The requirements community, the operators, if you will, determine what a system has to do. The acquisition process decides how we are going to build this thing to deliver the capabilities that the warfighter wants. In between there is this trade-off space between what is affordable, what is achievable, what is within the appropriate parameters of technical risk.

And there are a number of KPPs having to do with reach and range, survivability, lethality. And all of these exist within that trade space.

So we are now developing the tools to be able to understand how we establish a reasonable energy performance parameter for these systems.

Senator SHELBY. Without compromising the mission.

Mr. MOREHOUSE. Absolutely.

Senator SHELBY. Because that is number one.

Mr. MOREHOUSE. Yes, sir. That is absolutely right.

It is also recognizing that there is a burden of delivering fuel within a battle space in a contested area.

Those supply lines are legitimate targets. And if they interdict those supply lines, it affects our ability to maneuver. It means we have to take combat forces out of the front. We have to protect those lines of communication. That affects how much force the commanders have available to them to go accomplish the mission. And we had to game all of this out to understand what the operational implications are of setting these parameters.

I would also like to add, if I could, that over the past few years, the Under Secretary for AT&L has embarked upon an initiative to revise the acquisition process to try to identify where there have been problems with acquisition in the past, and use research and data analysis to try to fix those. Better Buying Power is an initiative that he has put in place.

And if we could take a question for the record, to illuminate those actions that the Under Secretary is taking to revise the acquisition process, I would appreciate that.

Senator SHELBY. Sure.

[The information follows:]

The Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)), HON Frank Kendall, has directed a number of parallel efforts to institute a long term and continuous process to improve the defense acquisition system. These efforts include: Better Buying Power; an interim policy update to the Department of Defense Instruction (DODI) 5000.02, "Operation of the Defense Acquisition System;" and a comprehensive review of current statutes and regulations with the aim of simplifying legislative requirements imposed on acquisition programs and institutions.

Better Buying Power (BBP) 2.0 reflects the ongoing commitment to continuous improvements in acquisition management. Significant progress has been made since BBP was first introduced almost 4 years ago. Affordability analysis and Should Cost planning have been implemented to improve investment decisions and to reduce costs across all types of acquisitions; Small-business participation and opportunities have been increasing since fiscal year 2011 as a direct result of BBP actions; and a renewed emphasis has been placed on increasing the professionalism of the acquisition workforce—people are essential to changing the culture of how we acquire goods and services to support the Warfighter.

BBP's emphasis on continuous process improvement resulted in an in-depth review and subsequent update to the Department's policies for the operation of the defense acquisition system, known as DODI 5000.02. The interim policy was released on November 25, 2013 and it:

- Decreases the emphasis on rules and increases the emphasis on thoughtful planning;
- Provides tailoring of program structures and procedures;
- Enhances the discussion of program management responsibility and key supporting disciplines; and
- Institutionalizes changes to statute and policy since the last issuance of DODI 5000.02 in December 2008.

In addition, the process of updating the DODI 5000.02 revealed that the current body of law has placed an unnecessarily complex burden on Program Managers. The USD (AT&L) has directed a comprehensive review of current statutes and regulations to prepare a legislative proposal to simplify the existing body of law and regulations while maintaining the overall intent of existing statute. The proposal should be finalized in time to be included in the fiscal year 2016 National Defense Authorization Act (NDAA).

FUEL COSTS

Senator SHELBY. Mr. Secretary, if you could save 10 percent, we will just use that as a marker, 10 percent in your energy costs because of efficiency, using what you have better, more efficiently and not waste, and also the procurement, the combination, how much money would that translate into?

Mr. MOREHOUSE. We spend about \$15 billion on liquid fuel. So if you just take 10 percent off the top——

Senator SHELBY. So a lot of money.

Mr. MOREHOUSE. \$1.5 billion. It is.

I will say though, that if we are actually conducting operations, the further you get to the tactical edge, the more energy it takes to deliver that energy, the more money it costs.

Senator SHELBY. He pointed it out. At \$400, you might buy two or three, and delivering it gets on up because of the cost of transportation.

Mr. MOREHOUSE. The actual dollar cost depends upon how contested the environment is and how far you have to deliver the fuel.

We have done some back-of-the-envelope calculations to try to understand, on a more global basis, what is that fully burdened cost of fuel, if you will. In Afghanistan, the forward operating bases are more around the \$40 mark. To deliver fuel out of the backend of an airborne tanker is probably more around the \$30 to \$40 mark

as well. So we get these pathologic cases where you have very extreme delivery costs, but those are the far end of the bell curve.

Senator SHELBY. I know the procurement process is not flexible. We understand that. But if you had some flexibility in buying oil, diesel, or jet fuel, and so forth, like an airline had or a railroad had, do you have any studies how much money that could possibly save? I know it depends on the market.

Mr. MOREHOUSE. In terms of our actual procurement?

Senator SHELBY. Flexibility. What could it save you, if you had some flexibility to go into the market at different times, rather than long-term procurement?

Mr. MOREHOUSE. The DLA has four contracts here that they award on a geographic basis. This is the fuel we buy for operations, our bulk fuel programs.

And these are 1-year contracts with an adjustability rate that is the same template, if you will, that the airlines use to buy fuel for themselves. There have been multiple studies that compare and contrast how DLA buys its fuel relative to how the airline industry or other very fuel intensive industries buy fuel. And there is strong comparability in terms of how this is done.

We have been asked by Congress to look at this notion of hedging, how would we hedge our buys so that we can manage those costs better.

Senator SHELBY. Like everybody else does, in the market.

Mr. MOREHOUSE. Yes, sir. We are in the process now of actually doing a study on that.

Senator SHELBY. Senator Durbin alluded to that earlier, how do you use some of the market principles in the procurement process.

Mr. MOREHOUSE. So we have a study going on that now, on how we would go about hedging and what the results would be.

I will say that hedging can be a tool for dampening out the price spikes.

Senator SHELBY. But hedging is just managing risk, is it not? Unless this is just gambling, and you are not gambling, because you are buying an end product.

Mr. MOREHOUSE. That is right.

Senator SHELBY. And you are managing the cost of it, or trying to, right?

Mr. MOREHOUSE. That is right.

We have some internal capacity for managing that volatility. We have a revolving fund for buying fuel, so all the services pay the same amount of money throughout the year for the fuel that they buy. Perturbations in the market price are absorbed by this revolving fund.

So we have some capability within the Department to avoid creating operational impacts from price volatility. Could we use more capacity? We are not quite sure yet, but we are doing a study to look into that. That study should be done this year.

Senator SHELBY. Thank you.

Thank you, Mr. Chairman.

Senator DURBIN. Senator Murkowski.

Senator MURKOWSKI. Thank you, Mr. Chairman.

ENERGY COSTS

Important conversation to be talking about how we are going to reduce our energy costs.

Mr. Morehouse, I don't know if you are familiar with a proposal that is being considered in the interior part of the State, in Fairbanks. They pay about \$.22 a kilowatt hour for their energy, don't have access to natural gas, options are limited. And they are underway now with a project that would allow for trucking of liquefied natural gas from the North Slope, bring it down into the interior.

It is estimated that energy costs in the region then could be reduced by about 20 percent.

I don't know if the military is looking at participating in this. It is called the Northern Rail built trucking project. But it is something that has been advanced with our Alaska Industrial Development and Export Authority, again, working with the principals there.

But it is something that if you haven't looked at, I might suggest that that is something that is worthy of consideration.

One of these days, we are going to get natural gas by pipeline down to the region. But until such time, we are looking at trucking it.

Mr. MOREHOUSE. If I could, I appreciate the challenges of living in rural Alaska. I had the pleasure of living in Galena for a year as the base engineer.

Senator MURKOWSKI. So you know.

Mr. MOREHOUSE. I understand the challenges up there. We ran our own power plant and our own utilities at the small base up there.

The installation issues when it comes to the bigger bases is really handled by my colleague, John Conger. So what I would like to do, if I could, is take that question back for the record, consult with John, and get back with you.

Senator MURKOWSKI. Great. That is wonderful.

Mr. MOREHOUSE. Thank you.

[The information follows:]

The Department appreciates the insights and details into the northern rail project currently underway in the State of Alaska to offer a potential avenue to more affordable and diversified energy solutions for our military installations. While the military is not presently participating in the rail project, it does consider a variety of solutions to pay lower utility costs, especially in more remote areas where costs are high. The Department will continue to monitor the rail project as it develops for the potential to deliver diversified and affordable energy to our military installations.

Senator MURKOWSKI. Let me ask a broader question. I have been focused, as the ranking member on the Energy Committee, on different pieces of what I believe to be a pretty considered approach to energy initiatives and policy.

And in a white paper that I released just a couple weeks ago, we focused on the nexus between energy and water. The amount of energy that it takes to move water, to treat water, is considerable. And the reverse is also.

So you cannot have the energy without water. And it is a balance in everything that we do. And yet it is not talked about a lot.

We talk about all these great processes that are going to allow us to access whatever the resource may be, but we don't think about it, necessarily, in terms of what does it mean for water consumption.

And when we talk about the issue of a changing climate and the impact not only on this country, but on nations around the globe, there is a great deal of interest and focus on drought.

I have suggested, and I am not the only one, that if there is a next world war, I don't think it is going to be fought over oil. I think it is going to be fought over water. And so how we acknowledge this, how we recognize it, how we work to reduce our water consumption, at the same time that we are talking about energy efficiencies, within DOD, how much attention is given to this aspect, the energy-water nexus?

WATER RESOURCE CHALLENGES AND POTENTIAL RESPONSES

Mr. MCGINN. Senator, you are absolutely right. It is energy-water and I would add environmental nexus to that construct.

I will use a case of our Navy and Marine Corps bases in the State of California, which is encountering a historic drought. We have made tremendous progress over the past 5 years in reducing our water consumption overall across all of our Navy and Marine Corps bases in excess of 25 percent.

In addition, because Governor Brown declared a state of emergency because of the drought, we have agreed for this year and going forward, as long as we need to, to try to get another 20 percent of water savings. This is done in a variety of ways, just plain old conservation, not using water where we might have before to wash vehicles, for example, or irrigation or what have you. There is a lot of recycling of water that is going on, graywater, in particular.

One of the things, in terms of thinking about water globally, I once heard that we don't have a water problem in this world, we have a salt problem. We just need to figure out how to get the good potable water out of the salt.

And that is enabled, I think, by large-scale, affordable, accessible, and renewable energy, where you can in fact use the renewable energy in various parts of the world to operate some sort of a distillery or desalinization plant or purification from contaminated water.

And I think that this is a perfect area where that nexus of water and energy really comes into being, especially in parts of the developing world where they don't even have the kind of access to water that we have in this country.

Senator MURKOWSKI. Dr. Chiu.

Dr. CHIU. Senator, if I could just add to that point, in terms of particularly looking longer term at the international security environment, you raise a great point about this nexus of issues.

You can actually add a few issues to it. We look at it very much as a nexus of things like energy, things like climate, things like food and water, but also demographics and longer term developmental patterns as well. All of these things can converge in ways that can really create significant instabilities in areas that we are

already looking at, or new instabilities in areas that we hadn't previously considered.

It is very complicated, particularly over time, to even track any one of these trends, and then to recognize that there are multiple ways in which they can combine and really have quite different manifestations over time makes it even more complicated.

But this highlights the need. We have been talking a lot about trying to exercise more flexibility and adaptability in the procurement system. I think it really highlights the need for us, in general, as a department, and I would argue more broadly as a government, to be able to exercise more of that flexibility and adaptability.

We obviously need to try to anticipate, to look out as far as we can. But because of the complexity of these issues, we are not always necessarily going to be able to pinpoint predict where these things are going to happen.

As a result, really ensuring that we have kind of a broad set of capabilities and the adjustability and flexibility we need to identify as early as possible these issues as they arise, and then to be ideally proactive in preventing them when we can.

That is really one of the things we are putting a lot of emphasis on, as we consider this extremely complex kind of emerging future security environment.

Senator MURKOWSKI. I appreciate the focus on it. You mention renewables and our opportunities there to address our water needs. I would hope that as the military is focusing on renewables that marine and hydrokinetic, harnessing the power that we have within our rivers.

Mr. Morehouse, you have been up to Galena. You are sitting right there on a pretty considerable river.

If we can't harness the power coming out of the Yukon, we are not putting on our smart hats here. And so many of our bases are co-located along rivers where we have great opportunity. So I would hope that marine and hydrokinetic is also something that we are closely looking at.

ALTERNATIVE ENERGY POSSIBILITIES

Mr. MCGINN. It is, and we are also looking at ocean energy as well, tidal, wave energy, and ocean thermal, across-the-board.

These are a little bit further out in time. But as you point out, we have a lot of water running low-head hydro, micro-hydro. Those are opportunities to harvest energy right now without any adverse environmental impact.

Senator MURKOWSKI. Good. Thank you.

Thank you, Mr. Chairman.

ADDITIONAL COMMITTEE QUESTIONS

Senator DURBIN. Thank you very much, Senator Murkowski.

I want to make a note, my predecessor, Paul Simon, wrote a book called Tapped Out 25 years ago that really reflects the conversation Senator Murkowski just had with the panel about the challenge of water in the 21st century.

As I recall about 20 percent of the water on this Earth is consumed for industrial purposes, about 10 percent for human con-

sumption, and 70 percent for agriculture. As we find new ways to grow crops and to feed the world with less water, we are also going to be addressing efficiency and the use of water.

I think most of us can agree this is likely to be a volatile issue for many years to come.

[The following questions were not asked at the hearing, but were submitted to the Department for response subsequent to the hearing:]

QUESTIONS SUBMITTED TO HON. DENNIS MCGINN

QUESTIONS SUBMITTED BY SENATOR RICHARD J. DURBIN

Question. Secretary McGinn, as you know, the Subcommittee has been very supportive of the Navy's Advanced Drop-in Biofuels program. Phase I awards were made last year, and we expect Phase II awards to be made by this summer. As a supporter of alternative energy solutions, I appreciate the Navy's leadership, and Congress continues to support this effort.

Critics of the program charge that biofuel at \$26.00 a gallon is unaffordable. What is your current estimate for the cost of a gallon of biofuel, and when will these fuels be used operationally?

Answer. It is projected that drop-in biofuels will be available in bulk for less than \$4 per gallon by 2016, making them cost competitive with conventional fuel. Department of Navy (DON) will only purchase biofuels for operational use when available at cost competitive rates per OSD Policy and the 2014 NDAA.

Biofuels annexes were inserted into the Defense Logistics Agency (DLA) Energy solicitation for the Western Pacific bulk fuels program. This means that cost competitive alternative fuels could enter into the DON JP-5 jet and F-76 marine diesel fuel streams in the Western Pacific as early as 1 January 2015.

In domestic markets, DLA Energy released the 2014 Inland/East/Gulf Coast bulk fuels solicitation, which seeks drop-in biofuels as part of the Navy's F-76 marine diesel and JP-5 shipboard jet fuel supply. The biofuels sought can be blended in a range from 10- 50 percent with conventional petroleum products. The Inland/East/Gulf Coast bulk fuels solicitation may utilize funds from the USDA's Commodity Credit Corporation to offset premiums associated with domestic feedstock costs. This ensures that DON will bear no additional costs for alternative vs. conventional fuels. Delivery of these fuels is slated to begin 1 April 2015.

Question. Are government investments in this project being matched with private investments?

Answer. Yes. The program requires that industry provide at least a 50 percent cost share for each phase of the Advanced Drop-in Biofuels Production Project. In Phase 1, industry provided \$22 million of the total \$42.5 million cost, for a 52 percent cost share. Phase 2 industry cost share amounts are not final as contract negotiations are still underway. Initial industry cost share projections are close to 70 percent of the over \$900 million required.

Question. Secretary McGinn, Mr. Morehouse, an unexpected aspect of the war in Afghanistan has been stories about how important fuel is. We've all heard about fuel convoys being attacked, disruptions of supplies as they truck in from Pakistan, and the importance of energy to a Forward Operation Base ("FOB") in some remote province. Now let's move to the Asia-Pacific theater. No war. Different goals. But the U.S. military is operating there now and anticipates a bigger presence in the future. One comparison I have is that the flight from Bagram to Kandahar burns 3,000 gallons of fuel, whereas Guam to Seoul burns 11,500 gallons and Guam to Singapore 16,000 gallons.

Extrapolate for this Subcommittee what are the energy challenges—and opportunities—imposed by geography in the Pacific?

Answer. Energy is a strategic resource and a critical combat enabler for Navy and Marine Corps operations. Every year, the Navy delivers 1.25 billion gallons of fuel to our worldwide operations. The need to maintain a continuous supply, coupled with price volatility in the marketplace, represents potential vulnerabilities to both the Warfighter and our national security. This is one of our Achilles' heels in operations, especially when seen through the lens of the Pacific area of operations. Our bases in Hawaii, Guam, and Diego Garcia are examples where conventional natural resources are limited, and the energy must be imported using a long supply line from the U.S. mainland or from foreign countries. By incorporating energy efficient

technologies and behaviors into operations afloat and ashore, the Navy can increase combat capability and resiliency, while reducing vulnerabilities.

While the Pacific creates challenges, it also presents opportunities to enhance our capabilities. The first opportunity is that it forces us to reconsider the Navy's energy security posture. Operating forward requires us to be more judicious in our use of operational resources. Finding both technological and operational ways to use less energy keeps us on station longer, where it matters, when it matters, and increases our combat range in theaters like the Pacific. Another opportunity exists to develop and leverage economic and military relationships with countries in the Asia-Pacific Theater in order to gain assured access to necessary resources. As we continue to rebalance to the Pacific, a theater that is characterized by a tyranny of distance, we will need to be judicious in our use of energy, understand our logistical supply challenges, and provide solutions for the future Fleet.

Question. Secretary McGinn, Mr. Morehouse, earlier this year, the U.S. Army and Honeywell announced a \$61 million public-private partnership agreement at Rock Island Arsenal to upgrade the manufacturing facility's energy systems, including its HVAC system and switching its power source from coal to natural gas. Here's the win-win: It will cut the base's energy bill by 35 percent and generate up to \$5.3 million in annual savings. The best part is that it doesn't cost the government a dime. It's using something called Energy Savings Performance Contracts. These agreements allow the companies to make the upfront capital investment, and then collect the first few years of energy savings generated by those upgrades. DOD has not used Energy Savings Performance Contracts for operational energy—vehicles, ships, and the like—but a bill I support, introduced by Senator Mark Udall, would give DOD that authority.

How can we expand this model? What opportunities is DOD looking at next?

Answer. Expanding the Energy Savings Performance Contract (ESPC) and Utility Energy Service Contract (UESC) models into operational energy would be a helpful addition to operational energy efforts. Both of these models leverage the private sector through third-party funding of energy efficiency projects. ESPCs and UESCs enable investments to be recouped through the realized savings from the project. This results decreased energy consumption without upfront capital costs.

The U.S. Navy partnered with the U.S. Coast Guard to examine an adapted UESC model for shipboard energy conservation measures onboard mobile U.S. Coast Guard assets at Coast Guard Base Miami Beach, FL. This pilot project will run from late 2014 through 2018, with installations occurring after the first 10 months, with 2–3 years of operating reviews focusing on the shipboard environment. Although currently funded by the government, the intention of the pilot is to encourage the use of future UESCs that are third-party funded. The main product of the pilot project will be a repeatable procurement process that can be applied to multiple assets, addressing both operational energy use at sea and shipboard use of shore power when moored. Results and lessons learned will inform policy discussions and consideration of similar efforts within the U.S. Navy.

Question. The U.S. is heavily invested in the Middle East and North Africa because of the important security relationships with our friends, but also because our adversaries could easily threaten the world's energy supply.

If our energy supplies come from more diverse sources, should that change how we deal with adversaries in the region?

Answer. Access to diverse sources of energy is in the strategic interest of the United States as it provides alternatives to importing petroleum products and limits the influence a petroleum supplier, or adversary can exert on national policy.

The United States commitment to our allies and partners in this region is not solely defined by energy sources. It is defined by common security objectives and shared values, which will remain threatened by adversaries.

If the U.S. were to broaden its energy diversity or achieve energy independence, it would increase resilience against strategic supply disruptions and dampen the effect of petroleum price volatility on U.S. operations, but it would not eliminate the threat from regional adversaries. For the near future, it is safe to assume:

- The world's energy supply will remain vulnerable and easily threatened by State and non-State actors.
- Adversaries will identify and adapt to target our strategic vulnerabilities. If we eliminate adversaries' abilities to target availability of energy, we would expect them to attempt to pressure a different vital interest or vulnerability.
- The United States and our partners will also adapt to the threats brought by regional adversaries by mitigating vulnerabilities while putting pressure on adversary vulnerabilities.

—Petroleum will continue to be a globally traded commodity whose price reflects the composite global supply and demand. Therefore regional supply uncertainties impact the entire global market.

While diversity of energy sources may allow the United States more freedom of action in the energy sector, we must always consider our allies and partners in any approach we take to regional threats. Given the assumption that the world's overall energy supply will remain vulnerable, it is anticipated that our approach towards adversaries will not change significantly.

QUESTION SUBMITTED BY SENATOR MARY L. LANDRIEU

Question. Access to water is critical for companies that provide electricity to our most important military installations.

As water resources become more precious can you provide an update on the impact of water resources on national security?

Answer. Increasing demand for water places stress on the same finite supplies of water that military installations depend on to fulfill their missions. In addition, the effects of a changing climate as well as near-term weather variability may exacerbate water shortages and make the management of water resources in the future more challenging.

The Department of the Navy is committed to having a thorough understanding of our current and future water needs for each military installation. Each installation and range will collect and maintain information associated with its water rights, and the Department will plan and manage our water resources to ensure the sustainment of our mission and enhance our water security.

QUESTIONS SUBMITTED TO EDWARD THOMAS MOOREHOUSE, JR.

QUESTIONS SUBMITTED BY SENATOR RICHARD J. DURBIN

Question. Mr. Morehouse, the Office of Operational Energy Plans and Programs was established in 2010, and you have recounted for us many of its achievements.

How do you measure the success of operational energy programs? Does OEPP have reliable metrics with which to track and evaluate the progress of these programs?

Answer. Operational energy is about more than increasing systems' energy efficiency or increasing energy availability. It is about increasing the operational capability of our combat forces while decreasing their operational risk. In that regard, when evaluating the worth, value, or success of an operational energy initiative, we seek to measure its effect on the force's operational capability and risk through scenario-based analysis which accurately represents friendly and enemy force structures, capabilities, and logistics requirements. My office is working with the Joint Staff, the Services, and other OSD offices to expand DOD's theater-level campaign analysis to include operational energy initiatives and measure their effect. I expect to have early results in fiscal year 2015.

Question. How is OEPP ensuring that its best practices regarding energy savings, and the best practices of the services, are being disseminated and that unnecessary duplication of programs is being avoided?

Answer. OEPP has taken tangible steps to publicize ongoing programs, disseminate lessons learned and share knowledge, and avoid duplication across the Services, Joint Staff, Combatant Commands, the Defense Agencies, and the military establishment. Here are some examples of actions we are taking to address this across key areas: OEPP facilitates recurring teleconference calls among key players across DOD to exchange information, discuss operational challenges, and bring group expertise to bear on challenging issues. We also cooperate with the Joint Staff to create a formal DOD Contingency Basing governance body with Service and stakeholder input, to help senior leaders guide development of future joint contingency bases.

Our Budget team has ongoing dialogue at the action officer level and regularly participates at a senior executive level in Service budget reviews, Service POM reviews, and Defense Acquisition Boards, Utilizing our annual Budget Certification process, which certifies the adequacy of the budget to the Secretary of Defense for implementing the Operational Energy Strategy, we and all the Services gain visibility into Service program investments across the DOD through a detailed review of all operational energy objectives. Through the Defense Operational Energy Board (DOEB), co-chaired by the ASD(OEPP) and the Joint Staff Director of Logistics, we communicate with the Services and receive Service input into our highest oper-

ational energy priorities. This serves to avoid duplicative efforts and drives collaboration across the Department.

Our office works with USD(Policy) to ensure operational energy is included during the Planning phase and in the Defense Planning Guidance, and the Quadrennial Defense Review. Following extensive collaboration across the Department, on 16 April 2014, Acting Deputy Secretary of Defense Christine H. Fox signed out DOD Directive 4180.01, "DOD Energy Policy." As the Department's first overarching defense energy policy in over 20 years, this new Directive provides a coherent energy framework to guide the full range of defense energy activities, including operational energy, facilities energy, and energy-related elements of mission assurance. The Directive also codifies responsibilities for implementing the energy policy across OSD, the Joint Staff, Combatant Commands, Military Services, and Defense Agencies.

We have established an Operational Energy Capability Improvement Fund (OECIF) to foster and incentivize innovation for improved operational energy performance and better align the Department's capabilities with the Operational Energy Strategy. The OECIF tends to emphasize technical areas that we believe the Service or the Department as a whole have not been concentrating enough resources. This mission has two key aspects. First, to develop and/or demonstrate operational energy technologies or practices that will improve the Department's military capabilities and/or reduce its costs. Second, to establish within the military Services sustainable, institutional capacity to continue to research, develop and adopt operational energy innovations. The Services propose programs which must be vetted by a Service Energy Office, ensuring buy-in. OECIF funds serve as "seed money" to consolidate or start promising operational energy programs; accordingly, OECIF emphasizes supporting or establishing programs, rather than one-off projects.

In fiscal year 2012 and fiscal year 2013, OECIF programs focused on reducing energy load at expeditionary outposts. OECIF strongly encourages joint programs, and requires regular communication, reviews, and informal sharing among programs. In fiscal year 2013 alternative business models which foster collaboration, such as consortia, were strongly encouraged. These consortia were to enable the participation of small businesses and non-traditional innovators, since much innovation in the energy space emanates from these sources. All of these mechanisms expand program impact and reduce duplication. For fiscal year 2014 we are focusing on analytic methods and tools to improve the Department's consideration of, and decision-making about, operational energy.

OEPP also is a leading participant in the Energy and Power Community of Interest (EPCOI). EPCOI is one of the oldest, most established DOD Communities of Interest that tie together relevant practitioners across DOD.

Through our DOE/DOD Memorandum of Understanding, we seek to leverage the complementary goals of DOD and DOE energy programs where it helps the DOD mission. We are also actively cooperate with the U.S. Agency for International Development and the Department of Homeland Security to find ways to share best practices, and improve the efficiency and effectiveness of programs with U.S. Government-wide impact.

Question. Secretary McGinn, Mr. Morehouse, an unexpected aspect of the war in Afghanistan has been stories about how important fuel is. We've all heard about fuel convoys being attacked, disruptions of supplies as they truck in from Pakistan, and the importance of energy to a Forward Operation Base ("FOB") in some remote province. Now let's move to the Asia-Pacific theater. No war. Different goals. But the U.S. military is operating there now and anticipates a bigger presence in the future. One comparison I have is that the flight from Bagram to Kandahar burns 3,000 gallons of fuel, whereas Guam to Seoul burns 11,500 gallons and Guam to Singapore 16,000 gallons.

Extrapolate for this Subcommittee what are the energy challenges—and opportunities—imposed by geography in the Pacific?

Answer. The 2014 Quadrennial Defense Review (QDR) summarized the broad challenges in the Pacific region as follows: "The Asia-Pacific region is increasingly central to global commerce, politics, and security. Defense spending in this region continues to rise. As nations in the region continue to develop their military and security capabilities, there is greater risk that tensions over long-standing sovereignty disputes or claims to natural resources will spur disruptive competition or erupt into conflict, reversing the trends of rising regional peace, stability, and prosperity. In particular, the rapid pace and comprehensive scope of China's military

modernization continues, combined with a relative lack of transparency and openness from China's leaders regarding both military capabilities and intentions.”¹

Related to energy in particular, the Department is fully aware of the “tyranny of distance” you describe and the additional challenges associated with the sheer size of the Asia Pacific region. The Department also will require a broader set of logistics and energy capabilities than those used to support contingency bases in Afghanistan; these additional logistics capabilities include aerial refueling, underway replenishment, air bases, ports, and air and sea lines of communication. As the QDR suggests, the Pacific also includes a different set of threats to energy than those in Afghanistan; U.S. logistics nodes in the Pacific may be subject to kinetic and cyber threats from air, sea, and land. Finally, the operating environment in the Pacific differs from the dry, hot environs of Afghanistan, and means a different set of challenges for optimizing the energy use by shelters and equipment at fixed and forward bases. Tactical power technologies will also be a challenge, with limited solar energy available under heavy jungle foliage, and moisture potentially affecting batteries.

In terms of opportunities, the Department's overall strategy of more fight, less fuel will pay particular dividends in the Pacific. U.S. forces with additional range, endurance, and persistence will be better able to counter the challenges outlined above. The Department's Operational Energy Capabilities Improvement Fund also is funding a specific initiative to improve the use of energy in tropical base camps. Finally, we are working with partners across the Pacific Rim to identify opportunities for cooperation, including cooperative research and development and coalition exercises that focus on improving the use of energy in military operations.

Question. Secretary McGinn, Mr. Morehouse, earlier this year, the U.S. Army and Honeywell announced a \$61 million public-private partnership agreement at Rock Island Arsenal to upgrade the manufacturing facility's energy systems, including its HVAC system and switching its power source from coal to natural gas. Here's the win-win: It will cut the base's energy bill by 35 percent and generate up to \$5.3 million in annual savings. The best part is that it doesn't cost the government a dime. It's using something called Energy Savings Performance Contracts. These agreements allow the companies to make the upfront capital investment, and then collect the first few years of energy savings generated by those upgrades. DOD has not used Energy Savings Performance Contracts for operational energy—vehicles, ships, and the like—but a bill I support, introduced by Senator Mark Udall, would give DOD that authority.

How can we expand this model? What opportunities is DOD looking at next?

Answer. While it may be appealing in theory to extend Energy Savings Performance Contracts (ESPCs) to non-building applications, there are key differences between using ESPCs for buildings and for other applications such as mobile systems. General, wide-ranging application of ESPCs to mobile systems will be more difficult and complex to manage for the taxpayer. For example, there are differences in potential scale of the projects and their commensurate financial risk to the government. Buildings can be upgraded individually, whereas operational systems are generally part of a fleet that would need be upgraded on a fleet-wide basis, so the financial risk would be greater. To provide some perspective, since 1997, Federal Agencies have invested over \$8 billion for facility energy upgrades through the ESPC program. A single project to upgrade an operational system, such as engines for a major platform, might exceed the Federal Government's total 17-year program value in ESPCs for buildings.

Another important difference is that our mobile systems under combat conditions may move into harm's way. The investment in upgrades could be lost, and DOD could be paying for upgrades to a system that is no longer operational. It would also be more difficult to calculate the actual savings of mobile systems because their use varies more. In the past, GAO has suggested that the cost to acquire assets through an ESPC is greater than through full and up-front appropriations. The scoring for facility ESPCs is also at variance with generally accepted scoring guidelines utilized by OMB, CBO, and the Budget Committees to assess the implication of actions on discretionary spending, direct spending, and receipts. It is unclear whether scoring rules would be set such that ESPCs for mobile systems would be practical.

Given the complexity, uncertainties and risks associated with extending ESPCs to non-building applications, including operational systems, a general legislative extension of the authority to enter into ESPCs is not recommended at this time.

Question. The U.S. is heavily invested in the Middle East and North Africa because of the important security relationships with our friends, but also because our adversaries could easily threaten the world's energy supply.

¹ http://www.defense.gov/pubs/2014_Quadrennial_Defense_Review.pdf.

If our energy supplies come from more diverse sources, should that change how we deal with adversaries in the region?

Answer. In 2013 remarks at the United Nations on U.S. policy in the Middle East, President Obama noted:

“We will ensure the free flow of energy from the region to the world. Although America is steadily reducing our own dependence on imported oil, the world still depends on the region’s energy supply, and a severe disruption could destabilize the entire global economy.”

The global nature of the oil market means that disruptions to any major source of oil supply affect the price of oil in all corners of the world. The Middle East and North Africa is the largest producing region in the world, accounting for a full one third of the world’s oil production. Any significant reduction of supply from this region will have economic reverberations around the globe.

While the U.S. is buying less oil from overseas, Middle Eastern oil remains an important component of U.S. energy supply and the foundation of global economic prosperity. The U.S. will remain prepared to use all elements of our power, including military force, to secure our core interests in the region.

QUESTIONS SUBMITTED BY SENATOR MARY L. LANDRIEU

Question. The State of Louisiana is home to some of the country’s most critical national security assets, including: Barksdale Air Force Base, Ft. Polk, the Louisiana National Guard, Naval Air Station Joint Reserve Base, and the Headquarters for the U.S. Marine Corps Forces Reserve Base.

In the face of a catastrophic weather event or man-made attack is the maturity of a micro-grid technology designed for our military installations a sufficient “resilient” energy source to satisfy the energy security demands in the immediate aftermath of a worst-case scenario?

Answer. On-site energy is critical to making our bases more energy secure. The deployment of advanced microgrid systems along with on-base energy generation and energy storage systems will allow a military base to maintain its critical operations “off-grid” for weeks or months if the commercial grid is disrupted. Smart microgrids and energy storage have the potential to offer a robust, cost effective approach to ensuring installation energy security. However, microgrid deployment requires technology, standards, and policies developing in parallel.

Today’s microgrid systems are relatively unsophisticated, with limited ability to integrate renewable and other distributed energy sources, little or no energy storage capability, uncontrolled load demands, and “dumb” distribution that is subject to excessive losses. By contrast, future microgrids will operate as local power networks that can utilize distributed energy, manage local energy supply and demand, and operate seamlessly both in parallel to the grid and disconnected from the grid if required. Future microgrids will also enable other renewable energy projects across DOD to power critical loads. There are currently multiple DOD Energy Test Bed projects that are integrating the elements of the microgrid model, including renewable energy generation. These include multi-year projects at Twentynine Palms Marine Corps Base and Fort Bliss. In the meantime, we are ensuring we use our current capabilities to maximum effect.

On December 16, 2013 the Acting Deputy Under Secretary of Defense (Installations and Environment) issued a memo to address power resilience on installations, specifically directing a power resilience review to examine installation adherence to key resilience policies, identify gaps in policy, and engage with Components to define future power resilience requirements.

Currently, the majority of DOD installations rely on on-site generators and backup fuel supplies to maintain mission-critical activities during weather events and outages. DOD Policies, such as the Department of Defense Instruction (DODI) 4170.11 Installation Energy Management, and the Defense Energy Program Policy Memorandum (DEPPM) 92–1, Department of Defense Energy Security Policy, require installations to evaluate their resilience by:

- Defining mission critical operations on installations and ensuring there is sufficient backup generating power to continue those missions,
- Developing plans to execute mission critical functions at alternative locations, and
- Ensuring existing utility contracts include emergency support contingency clauses

In addition to DOD policies, the Services have specific policies and guidance to ensure that mission-critical activities are identified and a sufficient amount of

backup power is available to maintain the mission and are required to take energy security into consideration as they develop their renewable energy plans.

Question. Access to water is critical for companies that provide electricity to our most important military installations.

As water resources become more precious can you provide an update on the impact of water resources on national security?

Answer. Water is critical to life itself and neither DOD nor our surrounding communities can function without adequate fresh water. The February 2012 Intelligence Community Assessment on Global Water Security remains the seminal document on water resources and national security. It states, “We assess that during the next 10 years, water problems will contribute to instability in States important to U.S. national security interests.” According to the report, “water problems when combined with poverty, social tensions, environmental degradation, ineffectual leadership, and weak political institutions— contribute to social disruptions that can result in State failure.” It also notes that water resources may play an increasing role in future regular and irregular conflict.

One part of this challenge for DOD is on facilities and installations. Some DOD installations are located in areas where water resources are limited and we have programs in place to reduce our water intensity. Our progress toward meeting annual water intensity reduction goals is provided each year in our Strategic Sustainability Performance Plan. DOD installations have reduced our water intensity by 19.8 percent (fiscal year 2013) since the baseline of fiscal year 2007. In addition, on May 23, 2014, DOD issued a policy memorandum, “Water Rights and Water Resources Management on DOD Installations and Ranges in the United States and Territories,” to ensure we know what water we have rights to and what resources are available to meet those rights. DOD is actively engaged in monitoring water needs and usage.

QUESTIONS SUBMITTED BY SENATOR LISA MURKOWSKI

Question. Mr. Morehouse, in answering my question about SMRs for the military, you stated that the DOD does not have the legal authority to enter into a Power Purchasing Agreement (PPA) when it comes to electricity generated from nuclear power. However, 10 U.S.C. 2922a—CONTRACTS FOR ENERGY OR FUEL FOR MILITARY INSTALLATIONS, the law that governs such power purchases, makes no mention of the specific exclusion of nuclear power-generated electricity (or for that matter any energy source) when it comes to the 30-year PPA authority the DOD has in this regard. Can you please explain the discrepancy between what you stated and the actual law?

Answer. While 10 U.S.C. 2922a makes no distinctions between different types of power production facilities, there are other considerations that likely render existing authorities inadequate to provide the level of support a nuclear power plant would require.

The 2922a authority is primarily exercised by DOD to enter into contracts with renewable energy providers that utilize proven and commercially available technologies for periods of up to 30 years—the maximum term authorized by the statute. The benefit to the developer is that these contracts enable them to secure the financing needed to construct energy production facilities such as solar photovoltaic and wind farms. The benefit to the Department is that we pay these electricity providers the same or lower rate per kilowatt-hour (\$/kWh) that we pay to acquire energy from traditional sources (e.g., utilities), while enhancing the energy security of installations and helping the U.S. Government progress towards meeting renewable energy targets specified in Federal policies and executive orders.

Building a nuclear reactor would require a much larger capital investment than other electricity production options, especially for a first-of-a-kind (FOAK) facility such as a small modular reactor (SMR). Even if FOAK costs were excluded, a recent study estimated that the required selling price of electricity from SMRs would be higher than the U.S. average price, but lower than the rate paid by some military installations in remote regions, assuming successful operation for several decades.²

Because of these considerations, the 30-year maximum term allowed under section 2922a would likely be insufficient to guarantee the funding stream needed to finance a nuclear power project, and/or the required selling price of electricity would not be competitive with alternative sources. Although section 2922a does not prevent DOD from entering into power purchase agreements with new nuclear power

² King, M., Huntzinger, R. L., & Nguyen, T. (2011). Feasibility of Nuclear Power on U.S. Military Installations. Center for Naval Analysis (CNA).

plants, the DOD would likely require additional authorities to do so, based on the current lack of commercially available nuclear technologies that could provide cost-effective power to military installations within the budgetary and time constraints of our existing contractual authorities.

Question. I think by now we all appreciate the need for safe, secure and resilient energy supply for all military operations. Has there been an effort to quantify what energy security and resilience mean? How does the DOD view these concepts?

Answer. In the DOD's view, the criticality of missions and potential impacts of energy disruptions define the required level of energy security and resilience. The DOD has several mechanisms that help ensure that critical missions have the reliable energy resources they need. The Defense Critical Infrastructure Program identifies and manages risks to the critical infrastructure that DOD relies upon to execute its missions. The Joint Staff's Joint Mission Assurance Assessment Pilot program sends experts to DOD facilities to assess risks, including energy security risks to critical DOD missions. The military Services also include energy security and resilience in their decisionmaking and notably, the Navy's "Energy Return on Investment" tool evaluates proposed energy projects in a balanced way for all value streams, including energy security and resilience.

QUESTIONS SUBMITTED BY SENATOR DANIEL COATS

Question. Generators are the biggest consumers of diesel fuel in war theaters for the Army and Marine Corps. In your written testimony, you stated that "Mission-specific advisory teams developed more efficient power generation and distribution plans, replaced older equipment with more than 500 fuel efficient Advanced Medium Mobile Power System generators and 430 Improved Environmental Control Units, updated distribution systems to improve reliability and safety, and trained local soldiers to operate and maintain the equipment properly." What are DOD's plans to recapitalize tactical generator systems taking into account energy efficiency innovations?

Answer. The U.S. Army has implemented a plan for recapitalizing all existing Tactical Quiet Generators (TQG) with Advanced Medium Mobile Power System (AMMPS) over 7 years. The initiative is in the second of the 7 year program and is approximately 25 percent complete. The fielding of AMMPS is expected to save the Army more than 50 million gallons of fuel annually. By focusing their efforts on solutions that reduce fuel usage on the battlefield the Army also addresses two problems: shrinking the amount of fuel the Army uses overall, and reducing the cost in lives, resources, and diverted combat forces for convoy protection as threats proliferate.

Question. What are the service fuel efficiency and reliability targets for the newest fleet of generator systems, and what is the financial impact that achieving these targets would have on fuel expenditures? Given Department of Defense directives to reduce costs through increased fuel efficiency, how does this impact and influence the Department of Defense's plan to procure equipment?

Answer. The fielding of the U.S. Army's newest fleet of generators, the Advanced Medium Mobile Power System (AMMPS), is approximately 2 years into the 7 year recapitalization program. The U.S. Army realized a number of benefits by replacing Tactical Quiet Generators (TQGs) with AMMPS, such as enhanced power generation capability, improved fuel efficiency, increased system reliability, reduced system size and weight, increased survivability for military applications and reduced total cost of ownership. Official testing indicates that the AMMPS fleet of generators ranging from 5—60 kW is approximately 21 percent more fuel efficient than existing TQGs. The fielding of AMMPS is projected to save the Army more than 50 million gallons of fuel annually, although fuel expenditures for military operations depend on many factors, including OPTEMPO. By focusing their efforts on solutions that reduce fuel usage on the battlefield the Army also addresses two problems: shrinking the amount of fuel the Army uses overall, and reducing the cost in lives, resources, and diverted combat forces for convoy protection as threats proliferate.

QUESTIONS SUBMITTED TO DR. DANIEL Y. CHIU

QUESTIONS SUBMITTED BY SENATOR RICHARD J. DURBIN

Question. The U.S. is heavily invested in the Middle East and North Africa because of the important security relationships with our friends, but also because our adversaries could easily threaten the world's energy supply.

If our energy supplies come from more diverse sources, should that change how we deal with adversaries in the region?

Answer. The United States has an interest in and remains committed to ensuring the free flow of energy around the world, even as we reduce our dependence on imported oil. The global nature of the oil market means that disruptions to any major source of oil supply affects the price of oil in all corners of the world, including at home. Since the Middle East and North Africa are the largest producing regions in the world, accounting for one third of the world's oil production, disruption in these regions could have economic reverberations around the globe. Therefore, the United States should remain prepared to use all elements of our power, including military force, to secure our core interests in the region if necessary.

Question. Last year Admiral Locklear stated that, in his judgment as the head of Pacific Command, climate change was the number one risk in the Asia-Pacific. He said he tells each of his new officers assigned the Pacific that they may be involved in a conflict but they are assured to be involved in a major disaster relief operation or its effects. The Military Advisory Board reinforces this, noting that 15 of 20 largest urban areas in the world are near the coast, and most of these are located in Asia.

What will the risk posed by climate change mean for the Asia-Pacific?

Answer. As Admiral Locklear said in reference to his area of responsibility in the Pacific Command, significant upheaval related to the impacts of climate change "is probably the most likely thing that is going to happen . . . that will cripple the security environment, probably more likely than the other scenarios we all often talk about." Climate change effects have the potential to impact parts of the Asia-Pacific region in various ways. As we have seen, sea-level rise and increased storm surge could make many of the low-lying coastal areas vulnerable to flooding. Low-lying islands in the region are particularly threatened by sea-level rise and could become completely uninhabitable in the coming decades. More broadly, areas that become uninhabitable could produce mass displacement of populations and destabilizing migration to other regions and other countries. Increasing speed of glacier melt in the region could exacerbate water resource stresses and competition. Water scarcity combined with changing temperatures could damage agriculture productivity and accelerate instability. Increased incidents of extreme weather could lead to heightened demand for humanitarian assistance and disaster relief, as well as undermine the legitimacy of governments that are unable to respond effectively to these disasters. These effects are threat multipliers that can aggravate stressors abroad such as poverty, environmental degradation, political instability, and social tensions—conditions that may enable terrorist activity and other forms of violence.

Question. How are you working to ensure that Pacific Command—and every other Combatant Commander around the world—is factoring this thinking into their planning, and has the resources to back it up?

Answer. The Quadrennial Defense Review serves as the Department's primary guidance to the Combatant Commanders to consider the impacts of climate change in their areas of responsibility. Furthermore, the Office of the Secretary of Defense works closely with Combatant Commanders to ensure they have the resources, including forward stationed forces and prepositioned material, to respond to natural disasters. Examples include the ability of U.S. forces to respond to the 2011 Tohoku earthquake and tsunami in Japan and to Typhoon Haiyan late last year in the Philippines. Assisting Allies and partners by responding with humanitarian assistance and disaster relief is an important element of our mission to build security globally. The Department is also assisting partner nations in developing their capabilities and capacity to respond to disasters internally and along their borders.

Question. As I noted in my opening statement, a 2008 National Intelligence Council found that more than 30 U.S. military installations were already facing elevated levels of risk from rising sea levels. The Military Advisory Board report has a startling image of the potential risk in sea level at Norfolk Naval Base. We can all quite easily picture other bases which are critical to our military's ability to operate around the world—Diego Garcia, for example—which may also be threatened by these changes. With more than 5,000 military bases worldwide, it is no small task to assess, let alone mitigate, these risks.

Has DOD begun a comprehensive review of military installations? How is the Department getting ahead of these risks?

Answer. The impacts of climate change are specific to individual sites. Led by OSD-AT&L (Installations and Environment), DOD initiated a baseline survey in 2013 of all sites to identify sites that are currently affected by impacts usually associated with a changing climate (flooding due to storm surge; flooding due to precipitation, i.e., rain, snow, ice, etc.; extreme temperatures; wind; drought; and wildfires). The survey also gathers data on current mean sea level and potential site impacts

from increases in mean sea level for those sites located with two kilometers of a coast or tidal body of water. The survey is continuing through 2014 and the data will be used by the military services to identify sites on which they need to do additional assessment. Vulnerability to climate change is not determined at a single point in time, but must be considered over an extended period and the risk managed appropriately. We have reviewed our planning processes and are incorporating the consideration of climate change impacts in our risk management frameworks. Managing the risk associated with a changing climate is just one additional component of assuring military mission readiness.

Question. Dr. Chiu, General Lewis, it is clear that coordinating policy regarding climate requires cooperation among many agencies and countries.

How does DOD view its role in this process, and how is the overall process working?

Answer. DOD participates in multiple interagency working groups that discuss climate change. These include the formally chartered working groups under Executive Order 13653, as well as informal groups such as the NASA coordinated Interagency Forum on Climate Change Impacts and Adaptations. The working groups provide a venue for agencies to share best practices and to identify topics where additional information is needed, as well as provide valuable communication channels to ensure that agencies working in the same region or area are aware of on-going efforts and eliminating redundancies. This structure allows the agencies that conduct and fund scientific research to see where additional research may be needed and enables all the agencies to benefit from methodologies that have worked for others. The process works quite well and DOD has benefited from our interactions with the other Federal agencies.

Question. How are other countries approaching climate change as a national security issue?

Answer. There is a wide range of ways in which other countries approach climate change as a national security issue. Governments and militaries around the world have identified climate change as a threat to their security. Many have addressed this threat in their defense and national security planning documents. Some have established climate change offices in their defense ministries, while others are just beginning to explore how to approach this issue. For some countries, climate change is a near-term existential threat, such as the concern low-lying islands have with sea-level rise, and thus climate change is a top national security priority for them. For other countries, it is less of a priority. The Department of Defense continues work with Allies and partners to share best practices on climate change adaptation and planning.

Question. Dr. Chiu, General Lewis, DOD planning regarding climate change has put a heavy focus on the Arctic.

What other regions or specific climate effects may require a similar focus?

Answer. Climate change impacts affect all regions of the world, with specific impacts such as sea-level rise, increased extreme weather, changing precipitation patterns, and rising global temperatures having differing effects depending on local conditions and dynamics. For example, loss of arable land and increased incidents of drought could accelerate instability in Africa. Increased incidents of extreme weather in Asia could challenge governments that are unable to respond effectively to these disasters. Europe could become a destination for refugees from [0]outside the Mediterranean region displaced by the effects of climate change. Increasing water scarcity in the Middle East could exacerbate existing tensions over resources. Rising sea levels could devastate island nations in the Pacific and Caribbean.

The Department of Defense is looking at the impacts of climate change in all regions, adjusting our activities in the region accordingly, and working with Allies and partners to protect mutual interests.

Question. Dr. Chiu, General Lewis, while the Navy's 2014 Arctic Roadmap estimates that we have the resources in place over the short-term (through 2020) to accomplish our objectives in the region, it also emphasizes that we must be prepared for changes in the Arctic to accelerate.

If your far-term estimates, starting in 2030, are accelerated by a decade, is it possible that we will need to consider an Arctic Pivot, as we are now doing in the Pacific?

Answer. Given the low potential for armed conflict in the region, a building up beyond what is required for existing DOD missions could send the wrong signal about our intentions for the region. The U.S. Government, including DOD, must account for and closely monitor the long-term dynamics in the Arctic. We will continue to train and operate routinely in the region as we monitor the changing environment, revisit threat assessments, and take appropriate action as conditions change. Regardless of the rate and scale of change, we must be ready to contribute to na-

tional efforts in pursuit of strategic objectives in the region. The DOD Arctic Strategy, which Secretary Hagel issued in November 2013, in support of the President's May 2013 National Strategy for the Arctic region, will enable us to take a balanced approach to improving security in the region. Our challenge is to balance the risk of having inadequate capabilities or insufficient capacity appropriate for this changing region with the opportunity cost of making premature and/or unnecessary investments. We assess that the Arctic is a relatively low threat environment, and that existing DOD infrastructure and capabilities in the region are adequate to meet current U.S. defense needs in the near and mid-term future. Capabilities and requirements will need to re-evaluated as conditions and regional activity change, and any gaps will need to be addressed.

QUESTION SUBMITTED BY SENATOR MARY L. LANDRIEU

Question. Access to water is critical for companies that provide electricity to our most important military installations.

As water resources become more precious can you provide an update on the impact of water resources on national security?

Answer. The February 2012 Intelligence Community Assessment on Global Water Security remains the seminal document on water resources and national security. Water is critical to life itself and neither DOD nor our surrounding communities can function without adequate fresh water. Some DOD installations are located in areas where water resources are limited and we have programs in place to reduce our water intensity. Our progress toward meeting annual water intensity reduction goals is provided each year in our Strategic Sustainability Performance Plan. DOD is actively engaged in monitoring water needs and usage and has reduced our water intensity by 19.8 percent (fiscal year 2013) since the baseline of fiscal year 2007.

QUESTIONS SUBMITTED TO BRIGADIER GENERAL KENNETH LEWIS

QUESTIONS SUBMITTED BY SENATOR RICHARD J. DURBIN

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SUBCOMMITTEE RECESS

Senator DURBIN. Thank you. Interesting panel. Interesting discussion for the subcommittee. We appreciate it very much.

We stand adjourned.

[Whereupon, at 11:21 a.m., Wednesday, May 21, the subcommittee was recessed, to reconvene subject to the call of the Chair.]